2. Subbasin Assessment – Water Quality Concerns and Status

This section discusses water quality data and the relationship to beneficial use support in more detail for each particular assessment unit. Since assessment units often encompass several streams, individual streams and their associated watersheds may be discussed separately from the rest of the assessment unit. The uniform use of assessment units began in mid-2004 and further explanation of what an assessment unit is provided below. Figure 15 shows the general boundaries of assessment units: these units may be further broken up by stream order, which are discussed for those particular streams/assessment units in Section 2.4. Streams that are not on the 303(d) list are included in this section for informational purposes even though they do not have impaired beneficial uses. This report presents all information that DEQ was able to gather regarding water bodies in the watershed, because this information allows the reader to gain a good understanding of the whole watershed.

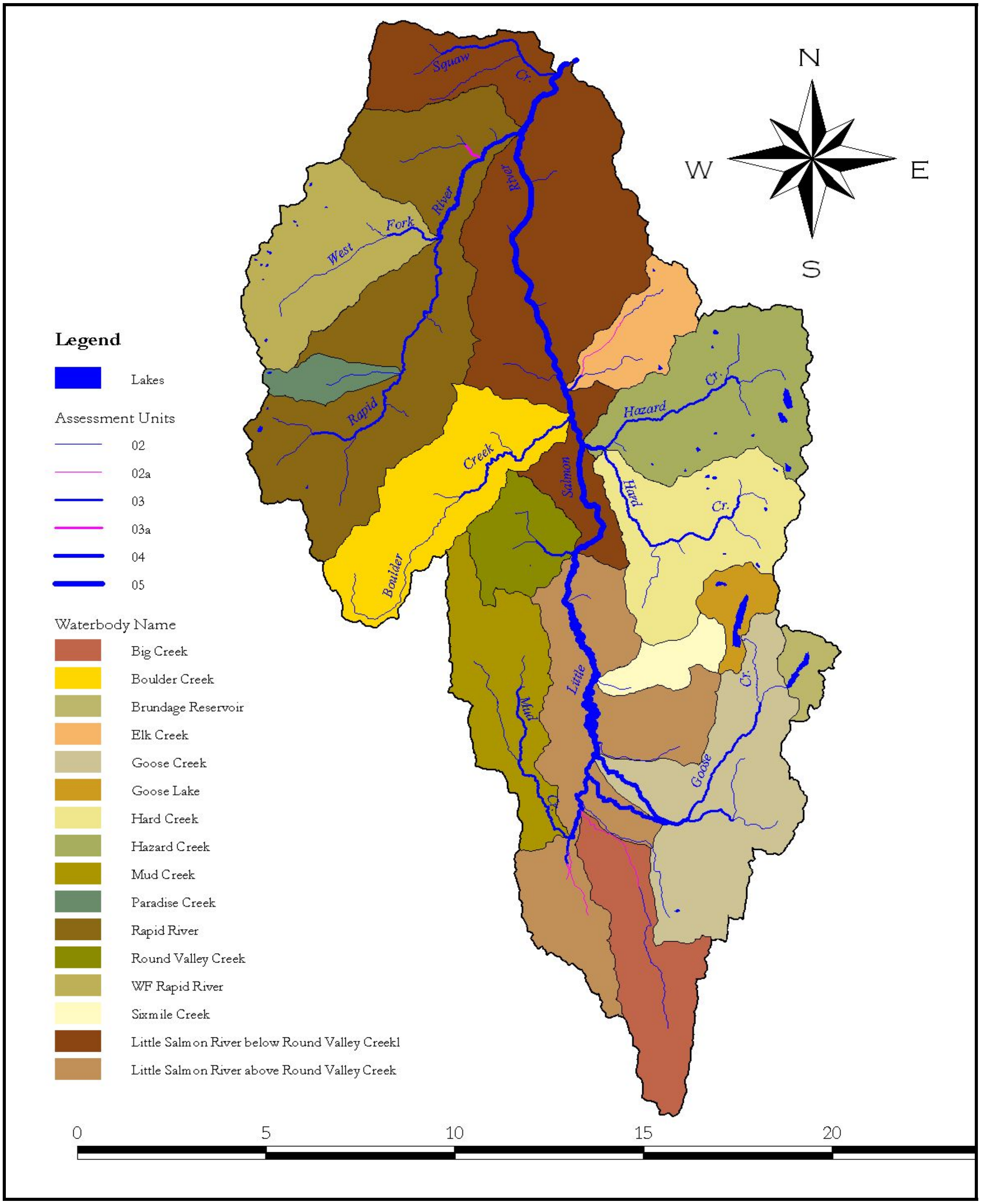

Figure 15. Little Salmon River Watershed Assessment Units.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

The Little Salmon River watershed contains several water quality limited assessment units. Table 8 summarizes these assessment units. See Figure 1 for general location of listed stream assessment units. This section will discuss which sections are water quality limited and the potential pollutants that are causing beneficial use impairment.

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet water quality standards must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

About Assessment Units

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs—although ownership and land use can change significantly, the AU remains the same. AUs now define all the waters of the state of Idaho. These units and the methodology used to describe them can be found in the WBAGII (Grafe et al 2002).

Using assessment units to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. In addition, using AUs fulfills the fundamental requirement of EPA's 305(b) report, a component of the Clean Water Act wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, there is now a direct tie to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

However, the new framework of using AUs for reporting and communicating needs to be reconciled with the legacy of 303 (d) listed streams. Due to the nature of the court-ordered 1994 303(d) listings, and the subsequent 1998 303(d) list, all segments were added with boundaries from "headwater to mouth." In order to deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ set about writing TMDLs at the watershed scale (HUC), so that all the waters in the drainage are and have been considered for TMDL purposes since 1994.

The boundaries from the 1998 303(d) listed segments have been transferred to the new AU framework, using an approach quite similar to how DEQ has been writing SBAs and TMDLs. All AUs contained in the listed segment were carried forward to the 2002 303(d) listings in Section 5 of the Integrated Report. AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the 303(d) list. This was necessary to maintain the integrity of the 1998 303(d) list and to maintain continuity with the TMDL program. When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the 303(d) list (Section 5 of the Integrated Report.).

Listed Waters

Table 8 shows the pollutants listed and the basis for listing for each §303(d) listed AU in the subbasin. Not all of the water bodies will require a TMDL, as will be discussed later. However, a thorough investigation, using the available data, was performed before this conclusion was made. This investigation, along with a presentation of the evidence of non-compliance with standards for several other tributaries, is contained in the following sections.

Table 8. 2002 §303(d) Segments in the Little Salmon River Subbasin.

Water Body Name	Assessment Unit ID Number	2002 §303(d) Boundaries	Pollutants	Listing Basis
Little Salmon River	17060210SL001_02	Round Valley Creek to Mouth	Sediment	EPA
Little Salmon River	17060210SL007_05	5th Order	Unknown	EPA
Little Salmon River	17060210SLO07_04	4th order	Temperature	EPA
Big Creek	17060210SL009_02a	1st and 2nd Order	Unknown	DEQ
Elk Creek	17060210SL016_03	Little Elk Creek to Mouth	Sediment	USFS
Indian Creek	17060210SL001_03	Source to Mouth	Sediment	EPA
Shingle Creek	17060210SL002_02a	2nd Order	Sediment	EPA
Brundage Reservoir	17060210SL011L-0L		Temperature	EPA

2.2 Applicable Water Quality Standards

Idaho adopts both narrative and numeric water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. By designating the beneficial use or uses for water bodies, Idaho has created a mechanism for setting criteria necessary to protect those uses and prevent degradation of water quality through anti-degradation provisions. According to IDAPA 58.01.02.050 (02)a "wherever attainable, surface waters of the state shall be protected for beneficial uses which includes all recreational use in and on the water surface and the preservation and propagation of desirable species of aquatic biota." Beneficial use support is determined by DEQ through its water body assessment process. Table 9 contains a listing of the designated beneficial uses for each listed segment. Table 10 contains a listing of the beneficial uses of assessed, non §303(d) listed streams. Table 11 is a summary of the water quality standards associated with the beneficial uses. For streams with no designated beneficial uses, cold water aquatic life and recreation are presumed to be beneficial uses. The following discussion focuses on beneficial uses and the water quality criteria, both narrative and numeric, applicable to each of the listed water bodies. A more detailed explanation of the numeric water quality targets developed as an interpretation of the narrative standards for nutrients and sediment can be found later in this section.

Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Existing Uses

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water body that could support salmonid spawning, but salmonid spawning is not occurring due to other factors, such as dams blocking migration.

Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.27 and .02.109-.02.160).

Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric cold water criteria and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g. intergravel dissolved oxygen, temperature). However, if for example, cold water aquatic life is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

A special resource water (SRW) has been designated as such because it has one of the following characteristics:

1. The water is of outstanding high quality, exceeding both criteria for primary contact recreation and cold water aquatic life
2. The water is of unique ecological significance
3. The water possesses outstanding recreational or aesthetic qualities
4. Intensive protection of the quality of the water is in paramount interest of the people of Idaho
5. The water is a part of the National Wild and Scenic River System, is within a State or National Park or wildlife refuge and is of prime or major importance to that park or refuge or;
6. Intensive protection of the quality of water is necessary to maintain an existing but jeopardized beneficial use.

Table 9. Little Salmon River Subbasin beneficial uses of §303(d) listed streams.

Water Body	Uses[a]
Little Salmon River	CW, SS, PCR, DWS, SRW
Big Creek	Undesignated
Brundage Reservoir	Undesignated
Elk Creek	Undesignated
Indian Creek	Undesignated
Shingle Creek	Undesignated

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply, SRW-special resource water

Table 10. Little Salmon River Subbasin beneficial uses of assessed, non-§303(d) listed streams.

Water Body	Uses[a]
Boulder Creek	Undesignated[b]
Goose Creek	Undesignated
Goose Lake	Undesignated
Hard Creek	Undesignated
Hazard Creek	Undesignated
Mud Creek	Undesignated
Paradise Creek	Undesignated
Rapid River	CW, PCR, SS, DWS, SRW
W. Fork Rapid River	Undesignated
Round Valley Creek	Undesignated

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply, SRW-special resource water
[b] undesignated assessment units are presumed to support cold water aquatic life and recreational uses

Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250) (Table 11).

Excess sediment is described by narrative criteria (IDAPA 58.01.02.200.08): “Sediment shall not exceed quantities specified in Sections 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.”

Narrative criteria for excess nutrients are described in IDAPA 58.01.02.200.06, which states: “Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.”

Narrative criteria for floating, suspended, or submerged matter are described in IDAPA 58.01.02.200.05, which states: “Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities.”

For those situations with temperature where the numeric criteria cannot be met due to natural conditions, IDAPA 58.01.02.200.09 states that “when natural background conditions, exceed any applicable water quality criteria set forth in Sections 21, 250, 251 or 253, the applicable water quality criteria shall not apply; instead pollutant levels shall not exceed the natural background conditions.”

DEQ’s procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.053. The procedure relies heavily upon biological parameters and is presented in detail in the Water Body Assessment Guidance (Grafe et al. 2002). This guidance requires the use of the most complete data available to make beneficial use support status determinations.

Table 11 includes the most common numeric criteria used in TMDLs to determine pollutants that might be impairing beneficial uses.

Figure 16 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

Table 11. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
Water Quality Standards: IDAPA 58.01.02.250				
Bacteria, pH, and Dissolved Oxygen	Less than 126 *E. coli*/100 ml[a] as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 ml	pH between 6.5 and 9.0 DO[b] exceeds 6.0 mg/L[c]	pH between 6.5 and 9.5 Water Column DO: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater Intergravel DO: DO exceeds 5.0 mg/L for a one day minimum and exceeds 6.0 mg/L for a seven day average
Temperature[d]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average Bull trout: not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June – August; not to exceed 9 °C daily average in September and October at elevations greater than 4592 feet
Turbidity			Turbidity shall not exceed background by more than 50 NTU[e] instantaneously or more than 25 NTU for more than 10 consecutive days.	
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature				7 day moving average of 10 °C or less maximum daily temperature for June - September

[a] *Escherichia coli* per 100 milliliters
[b] dissolved oxygen
[c] milligrams per liter
[d] Temperature Exemption - Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.
[e] Nephelometric turbidity units

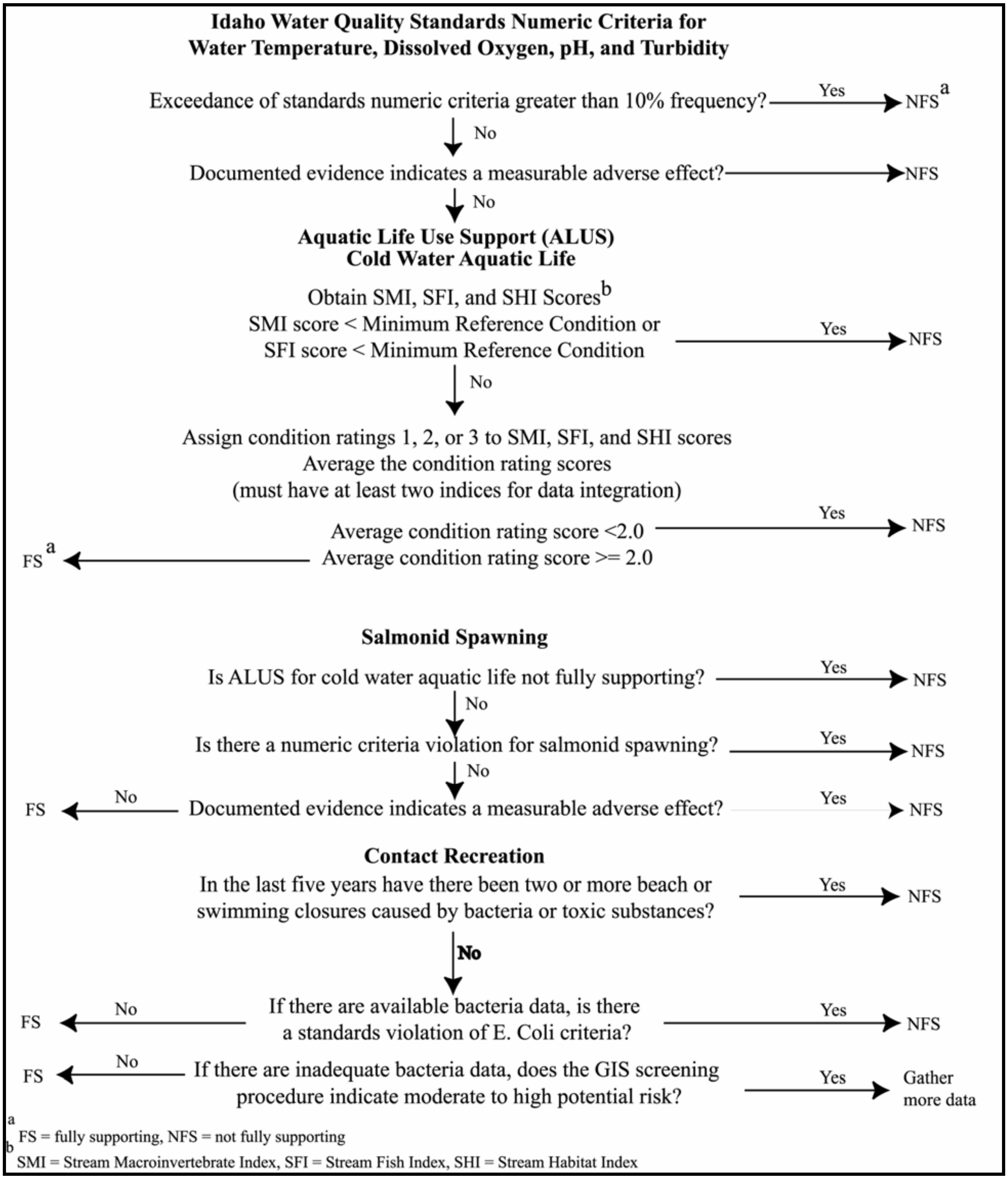

Figure 16. Process for determining support status of beneficial uses in wadeable streams: *Water Body Assessment Guidance*, Second Addition (Grafe *et al*. 2002).

2.3 Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses in streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally have sediment, nutrients, and the like, but when anthropogenic sources cause these to reach unnatural levels, they are considered “pollutants” and can impair the beneficial uses of a stream. The following sections discuss pollutants that may be impairing beneficial uses in the Little Salmon River basin in more detail.

Temperature

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or coldwater aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human influenced factors include heated discharges (such as those from point sources), riparian alteration, channel alteration, and flow alteration.

Elevated stream temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with cold water species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower threshold value than the adults, retarding growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of affects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

Dissolved Oxygen

Oxygen is necessary for the survival of most aquatic organisms and essential to stream purification. Dissolved oxygen (DO) is the concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter (mg/L), parts per million, or percent of saturation. While air contains approximately 20.9% oxygen gas by volume, the proportion of oxygen dissolved in water is about 35%, because nitrogen (the remainder) is less soluble in water. Oxygen is considered to be moderately soluble in water. A complex set of physical conditions that include atmospheric and hydrostatic pressure, turbulence, temperature, and salinity affect the solubility.

Dissolved oxygen levels of 6 mg/L and above are considered optimal for aquatic life. When DO levels fall below 6 mg/L, organisms are stressed, and if levels fall below 3 mg/L for a prolonged period, these organisms may die; oxygen levels that remain below 1-2 mg/L for a few hours can result in large fish kills. Dissolved oxygen levels below 1 mg/L are often referred to as hypoxic; anoxic conditions refer to those situations where there is no measurable DO.

Juvenile aquatic organisms are particularly susceptible to the effects of low DO due to their high metabolism and low mobility (they are unable to seek more oxygenated water). In addition, oxygen is necessary to help decompose organic matter in the water and bottom sediments. Dissolved oxygen reflects the health or the balance of the aquatic ecosystem.

Oxygen is produced during photosynthesis and consumed during plant and animal respiration and decomposition. Oxygen enters water from photosynthesis and from the atmosphere. Where water is more turbulent (e.g., riffles, cascades), the oxygen exchange is greater due to the greater surface area of water coming into contact with air. The process of oxygen entering the water is called aeration.

Water bodies with significant aquatic plant communities can have significant DO fluctuations throughout the day. An oxygen sag will typically occur once photosynthesis stops at night and respiration/decomposition processes deplete DO concentrations in the water. Oxygen will start to increase again as photosynthesis resumes with the advent of daylight.

Temperature, flow, nutrient loading, and channel alteration all impact the amount of DO in the water. Colder waters hold more DO than warmer waters. As flows decrease, the amount of aeration typically decreases and the in-stream temperature increases, resulting in decreased DO. Channels that have been altered to increase the effectiveness of conveying water often have fewer riffles and less aeration. Thus, these systems may show depressed levels of DO in comparison to levels before the alteration. Nutrient enriched waters have a higher biochemical oxygen demand due to the amount of oxygen required for organic matter decomposition and other chemical reactions. This oxygen demand results in lower in-stream DO levels.

Sediment

Both suspended (floating in the water column) and bedload (moves along the stream bottom) sediment can have negative effects on aquatic life communities. Many fish species can tolerate elevated suspended sediment levels for short periods of time, such as during natural spring runoff, but longer durations of exposure are detrimental. Elevated suspended sediment levels can interfere with feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, and in extreme cases eventually lead to death.

Newcombe and Jensen (1996) reported the effects of suspended sediment on fish, summarizing 80 published reports on streams and estuaries. Increased levels of sediment yield can adversely affect fish habitat by changes to fish embryo survival, summer rearing capacity, and winter carrying capacity. An inverse relationship exists between the amount of deposited fine sediments in spawning or rearing areas and fish survival and abundance. For rainbow trout, physiological stress, which includes reduced feeding rate, is evident at suspended sediment concentrations of 50 to 100 mg/L when those concentrations are maintained for 14 to 60 days.

Similar effects are observed for other species, although the data sets are less reliable. Adverse effects on habitat, especially spawning and rearing habitat presumably from sediment deposition, were noted at similar concentrations of suspended sediment.

Organic suspended materials can also settle to the bottom and, due to their high carbon content, lead to low intergravel DO through decomposition.

In addition to these direct effects on the habitat and spawning success of fish, detrimental changes to food sources may also occur. Aquatic insects, which serve as a primary food source for fish, are affected by excess sedimentation. Increased sedimentation leads to a macroinvertebrate community that is adapted to burrowing, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community is diminished due to the reduction of coarse substrate habitat.

Settleable solids are defined as the volume (milliliters [ml]) or weight (mg) of material that settles out of a liter of water in one hour. Settleable solids may consist of large silt, sand, and organic matter. Total suspended solids (TSS) are defined as the material collected by filtration through a 0.45 µm (micrometer) filter (Standard Methods 1975, 1995). Settleable solids and TSS both contain nutrients that are essential for aquatic plant growth. Settleable solids are not as nutrient rich as the smaller TSS, but they do affect river depth and substrate nutrient availability for macrophytes. In low flow situations, settleable solids can accumulate on a stream bottom, thus decreasing water depth. This increases the area of substrate that is exposed to light, facilitating additional macrophyte growth.

Bacteria

Escherichia coli or E. coli, a species of fecal coliform bacteria, is used by the state of Idaho as the indicator for the presence of pathogenic microorganisms. Pathogens are a small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa), which, if taken into the body through contaminated water or food, can cause sickness or even death. Some pathogens are also able to cause illness by entering the body through the skin or mucous membranes. Direct measurement of pathogen levels in surface water is difficult because pathogens usually occur in very low numbers and analysis methods are unreliable and expensive. Consequently, indicator bacteria which are often associated with pathogens, but which generally occur in higher concentrations and are thus more easily measured, are assessed.

Coliform bacteria are unicellular organisms found in feces of warm-blooded animals such as humans, domestic pets, livestock, and wildlife. Bacteria is found in both point source discharge (a discrete source like a pipe or an identifiable point of discharge into a water body) and nonpoint source runoff (a dispersed source of pollutants from a geographical area from activities like agriculture, forestry, or stormwater runoff from cities and subdivisions). Coliform bacteria are commonly monitored as part of point source discharge permits (National Pollution Discharge Elimination System [NPDES] permits), but may also be monitored in nonpoint source arenas. The human health effects from pathogenic coliform bacteria range from nausea, vomiting, and diarrhea to acute respiratory illness, meningitis, ulceration of the intestines, and even death. Coliform bacteria do not have a known effect on aquatic life. The bacteria have a lifespan of 24-30 hours outside the intestinal tracks of warm-blooded animals, meaning that bacteria do not persist in streams beyond 24-30 hours after entering the water.

Coliform bacteria from both point and nonpoint sources impact water bodies, although point sources are typically permitted and offer some level of bacteria-reducing treatment prior to discharge. Nonpoint sources of bacteria are diffuse and difficult to characterize. Unfortunately, nonpoint sources often have the greatest impact on bacteria concentrations in water bodies. This is particularly the case in urban storm water and agricultural areas. *E. coli* is often measured in colony forming units (cfu) per 100 ml.

Recent studies have shown, that grass fed cattle as opposed to grain fed cattle, have a much lower incidence of the E. coli strain 0157:H7 which has been linked to outbreaks of infections in humans. Additionally, grass fed cattle produce less acid resistant bacteria which makes it less likely that the bacteria will survive in the human digestive tract than acid resistant bacteria (Cornell News, 1998).

Cornell University researchers have discovered that grassfed cows have a less acidic digestive tract than grainfed cows, so their E. coli does not have a chance to become acclimated to an acid environment. This translates into the probability that more than 99% of the bacteria found associated with grassfed cows would be destroyed by human digestive juices if ingested (Cornell News 1998).

Nutrients

While nutrients are a natural component of the aquatic ecosystem, natural cycles can be disrupted by increased nutrient inputs from anthropogenic activities. The excess nutrients result in accelerated plant growth and can result in a eutrophic or enriched system.

The first step in identifying a water body's response to nutrient flux is to define which of the critical nutrients is limiting. A limiting nutrient is one that normally is in short supply relative to biological needs. The relative quantity affects the rate of production of aquatic biomass. Either phosphorus or nitrogen may be the limiting factor for algal growth, although phosphorous is most commonly the limiting nutrient in Idaho waters. Ecologically speaking, a resource is considered limiting if the addition of that resource increases growth.

Total phosphorus (TP) is the measurement of all forms of phosphorus in a water sample, including all inorganic and organic particulate and soluble forms. In freshwater systems, typically greater than 90% of the TP present occurs in organic forms as cellular constituents in the biota or adsorbed to particulate materials (Wetzel 1983). The remainder of phosphorus is mainly soluble orthophosphate, a more biologically available form of phosphorus than TP that consequently leads to a more rapid growth of algae. In impaired systems, a larger percentage of the TP fraction is comprised of orthophosphate. The relative amount of each form measured can provide information on the potential for algal growth within the system.

Nitrogen may be a limiting factor at certain times if there is substantial depletion of nitrogen in sediments due to uptake by rooted macrophyte beds. In systems dominated by blue-green algae, nitrogen is not a limiting nutrient due to the algal ability to fix nitrogen at the water/air interface.

Total nitrogen to TP ratios greater than seven are indicative of a phosphorus-limited system while those ratios less than seven are indicative of a nitrogen-limited system. Only biologically available forms of the nutrients are used in the ratios because these are the forms that are used by the immediate aquatic community.

Nutrients primarily cycle between the water column and sediment through nutrient spiraling. Aquatic plants rapidly assimilate dissolved nutrients, particularly orthophosphate. If sufficient nutrients are available in either the sediments or the water column, aquatic plants will store an abundance of such nutrients in excess of the plants' actual needs, a chemical phenomenon known as luxury consumption. When a plant dies, the tissue decays in the water column and the nutrients stored within the plant biomass are either restored to the water column or the detritus becomes incorporated into the river sediment. As a result of this process, nutrients (including orthophosphate) that are initially released into the water column in a dissolved form will eventually become incorporated into the river bottom sediment. Once these nutrients are incorporated into the river sediment, they are available once again for uptake by yet another life cycle of rooted aquatic macrophytes and other aquatic plants. This cycle is known as nutrient spiraling. Nutrient spiraling results in the availability of nutrients for later plant growth in higher concentrations downstream.

Sediment – Nutrient Relationship

The linkage between sediment and sediment-bound nutrients is important when dealing with nutrient enrichment problems in aquatic systems. Phosphorus is typically bound to particulate matter in aquatic systems and, thus, sediment can be a major source of phosphorus to rooted macrophytes and the water column. While most aquatic plants are able to absorb nutrients over the entire plant surface due to a thin cuticle, bottom sediments serve as the primary nutrient source for most sub-stratum attached macrophytes. Sediment acts as a nutrient sink under aerobic conditions. However, when conditions become anoxic, sediments release phosphorus into the water column. The United States Department of Agriculture determined that other than harvesting and chemical treatment, the best and most efficient method of controlling growth is by reducing surface erosion and sedimentation.

Sediments can play an integral role in reducing the frequency and duration of phytoplankton blooms in standing waters and large rivers. In many cases there is an immediate response in phytoplankton biomass when external sources are reduced. In other cases, the response time is slower, often taking years. Nonetheless, the relationship is important and must be addressed in waters where phytoplankton is in excess.

Floating, Suspended, or Submerged Matter (Nuisance Algae)

Algae are an important part of the aquatic food chain. However, when elevated levels of algae impact beneficial uses, the algae are considered a nuisance aquatic growth. The excess growth of phytoplankton, periphyton, and/or macrophytes (rooted aquatic plants) can adversely affect both aquatic life and recreational water uses. Algal blooms occur where adequate nutrients (nitrogen and/or phosphorus) are available to support growth. In addition to nutrient availability, flow rates, velocities, water temperatures, and penetration of sunlight in the water column all affect algae (and macrophyte) growth. Low velocity conditions allow algal concentrations to increase because physical removal by scouring and abrasion does not readily occur. Increases in temperature and sunlight penetration also result in increased algal growth. When the aforementioned conditions are appropriate and nutrient concentrations exceed the quantities needed to support normal algal growth, excessive blooms may develop.

When algae die in low flow velocity areas, they sink slowly through the water column, eventually collecting on the bottom sediments. The biochemical processes that occur as the algae decompose remove oxygen from the surrounding water. Because most of the decomposition occurs within the lower levels of the water column, a large algal bloom can substantially deplete DO concentrations near the bottom. Low DO in these areas can lead to decreased fish habitat as fish will not frequent areas with low DO. Both living and dead (decomposing) algae can also affect the pH of the water due to the release of various acid and base compounds during respiration and photosynthesis. Additionally, low DO levels caused by decomposing organic matter can lead to changes in water chemistry and a release of phosphorus to the water column at the water/sediment interface.

Excess nutrient loading can be a water quality problem due to the direct relationship of high TP concentrations on excess algal growth within the water column, combined with the direct effect of the algal life cycle on DO and pH within aquatic systems. Therefore, the reduction of TP inputs to the system can act as a mechanism for water quality improvements Phosphorus management within these systems can potentially result in improvement in nutrients (phosphorus), nuisance algae, DO, and pH.

2.4 Summary and Analysis of Existing Water Quality Data

This section presents the most recent data for both 303(d) listed streams/assessment units and non 303(d) listed streams/assessment units in the watershed. All 303(d) listed streams/assessment units are included in this section and the information presented is used to determine whether beneficial uses (i.e. fisheries, recreation) are impaired. A TMDL is necessary to restore beneficial uses if the data shows that beneficial uses are impaired.

Data Assessment Methods

Several primary methods were used to evaluate the data for this subbasin assessment. A brief description of each method is located below. Where there were numeric criteria for pollutants like temperature and bacteria, the data were initially assessed by comparing results to the numeric standard. More information about targets used for narrative criteria such as sediment and nutrients is found in section 5 in the Water Quality Targets section for water bodies that have TMDLs.

DEQ-Water Body Assessment Guidance – Second Edition (Grafe et al. 2002)

The Water Body Assessment Guidance (WBAG) describes DEQ’s methods used to consistently evaluate data and determine the beneficial use support status of Idaho water bodies. The WBAG utilizes a multi-index approach to determine overall stream support status. The methodology addresses many reporting requirements of state and federal rules, regulations, and policies. For the most part, DEQ Beneficial Use Reconnaissance Program (BURP) data are used in the assessment. However, where available, other data are integrated into the assessment process.

An assessment entails analyzing and integrating multiple types of water body data such as biological, physical/chemical, and landscape data to address multiple objectives. The objectives are as follows:

1. Determine beneficial use support status of the water body (i.e., fully supporting versus not fully supporting).

2. Determine biological integrity using biological information or other measures.
3. Compile descriptive information about the water body and data used in the assessment.

The multi-metric index approach measures biological, physiochemical, and physical habitat conditions within a stream. The indexes include several characteristics to gauge overall stream health. Three primary indexes are used, which include the Stream Macroinvertebrate Index (SMI), the Stream Fish Index (SFI) and the Stream Habitat Index (SHI). The SMI is a direct measure of cold water aquatic life health. The SFI is also a direct measure of cold water aquatic life health, but it is also specific to fish populations. The SHI is used to measure in-stream habitat suitability, although some of the measurements used to generate the SHI are linked to the riparian area.

A few of the habitat parameters that are discussed individually in this report in reference to DEQ, USFS, and BLM data are described below:

Width Depth Ratio

Width-to-depth ratio (W:D) provides a dimensionless index of channel morphology, and can be an indicator of change in the relative balance between sediment load and sediment transport capacity (MacDonald and others 1991). Large W:D ratios are often a result of lateral bank excursion due to increased peak flows, sedimentation, and eroding banks (Overton et al. 1995). Aberrant W:D ratios can cause reduced pool numbers (Beschta and Platts 1986), increased stream temperature, increased bank erosion and thus direct sediment delivery, decreased riparian vegetation and associated diminished ability of riparian area to capture nutrients and sediment (MacDonald et al. 1991). In the Idaho Batholith, W:D ratios of <10 (INFISH RMO) are not common in even wilderness streams (Overton et al. 1995).

Pools and Large Woody Debris

A pool is a portion of the stream with reduced water velocity and water deeper than the surrounding area. The bottom of a pool is often concave. There are four basic types of pools: large-shallow, large-deep, small-shallow, and small-deep. In general, the greater the pool type diversity, the better the habitat.

Pools provide important resting and feeding habitat for fish. Overton et al. (1993) found pools in less impacted watersheds were more frequent, had higher volumes, and were of greater depth than those in more impacted watersheds.

Trees provide shade and stream bank stability because of their large size and massive root systems. As trees mature and fall into or across streams, they not only create high-quality pools and riffles, but their large mass also helps to control the slope and stability of the channel (Platts 1983). Large woody debris (LWD) influences sediment transport in streams by forming depositional sites (MacDonald et al. 1991). Wood was responsible for storing half the sediment in several small streams in Idaho (Megahan and Nowlin 1976). In many aquatic habitats, if it were not for the constant entry of large organic debris (trees) into the streams, the channel would degrade and soon flow on bedrock, leaving insufficient spawning gravels and few high-quality rearing pools for fish (Platts et al. 1987). LWD is one of the most important sources of habitat and cover for fish populations in streams (MacDonald et al. 1991).

Width-to-Maximum-Depth Ratio

Width-to-maximum-depth ratio is calculated for scour pools based on mean scour pool width and maximum depth. Width max depth is a useful indicator of scour pool condition. Elevated in-stream sediment, as indicated by percent fines data, would be expected to settle and reduce depth in lower gradient habitats (i.e. pools).

Bank Stability

Bank stability is rated by observing existing or potential detachment of soil from upper and lower stream banks and its potential movement into the stream. Measurements of bank angle and bank height may also be taken. Generally, steeper banks are more subject to erosion and correspondingly streams with largely unstable banks will often have poor in-stream habitat. Eroding banks can result in sedimentation, excessively wide streams, decreased depth and lack of vegetative cover. Banks that are protected by plant root systems or boulder/rock material are less susceptible to erosion.

Surface Fines

The particle size of the substrate directly affects the flow resistance of the channel, stability of the streambed, and the amount of aquatic habitat. If the substrate is predominantly composed of fines, then the spaces between the particles are too small to provide refuge for most organisms. The greatest number of species, and thus the greatest diversity, is found with a complex substrate of boulders, stone, gravels, and sand. Coarse materials such as gravels provide a variety of small niches for juvenile fish and benthic invertebrates. Because salmonids have adapted to the natural size distributions of substrate materials, no single sized particle class will provide the optimum conditions for all life stages of salmonids. A mix of gravel with a small amount of fine sediment and small rubble creates optimal conditions for fish spawning. When small fines (<6.35 mm) exceed 20-25% of the total substrate, embryo survival and emergence of swim-up fry is reduced by 50% (Bjornn and Reiser 1991).

Reference Conditions

In order to determine whether measurements of the above habitat parameters are indicative of impairment, they were compared to reference condition measurements made in pristine streams of similar stream channel and geologic parent types. Reference condition refers to a condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. It is a benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment

Cumulative Watershed Effects (CWE) Assessment Methodology

Idaho Code Section 38-1303 (17) defines cumulative watershed effects as "*...the impact on water quality and/or beneficial uses which result from the incremental impact of two (2) or more forest practices. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time*." The CWE methodology is designed, first, to examine conditions in the forest watershed surrounding a stream, and then in the stream itself. It then attempts to identify the causes of any adverse conditions. Finally, it helps to identify actions that will correct any identified adverse conditions. The CWE process is utilized for identifying general watershed problems and not as readily for estimating existing loads (quantities) of pollutants.

The CWE process consists of seven specific assessments:

1) Erosion and Mass Failure Hazards
2) Canopy Closure/Stream Temperature
3) Channel Stability
4) Hydrologic Risks
5) Sediment Delivery
6) Nutrients, and
7) Beneficial Uses/Fine Sediment

StreamStat

StreamStats is a method of determining stream flow in basins where stream gage information is lacking. StreamStats, a cooperative effort of the USGS and ESRI, Inc., is an integrated GIS application that uses ArcIMS , ArcSDE , ArcGIS , and the ArcHydro Tools. It incorporates a map-based user interface for site selection; a Microsoft Access database that contains information for data-collection stations; a GIS program that delineates drainage-basin boundaries and measures physical and climatic characteristics of the drainage basins; and a GIS database that contains land elevation models, historic weather data, and other data needed for measuring drainage-basin characteristics and for locating sites of interest in the user interface.

After StreamStats measures the drainage-basin characteristics, the values are input to a separate program named the USGS National Flood Frequency Program (NFF) , which is a Microsoft Windows program that contains all of the USGS-developed equations for estimating flood-frequency statistics in the Nation. NFF has been modified for StreamStats so that it can also contain equations for estimating other types of stream flow statistics. Estimates provided by StreamStats assume natural flow conditions at the site.

Equations for estimating monthly exceedance (80-, 50-, and 20-percent) and mean annual discharge values at ungaged sites were developed using a multiple-regression analysis. The analysis related stream flow to eight basin characteristics. These eight standard characteristics were: drainage area (A), mean basin elevation (E), basin relief (BR), slopes greater than 30 percent (S30), mean annual precipitation (P), forested area (F), basin slope (BS), and main channel slope (MCS).

StreamStats estimates stream flow and there is a range of error associated with these estimates that varies from drainage to drainage. Thus, while StreamStats can give an estimate of the flow, it may be higher or lower than estimated, particularly if there are management activities in the area that affect flow.

Little Salmon River

Subwatershed characteristics for the Little Salmon River, including fisheries, are covered in Section 2. The Little Salmon River is comprised of two assessment units, which include many of its tributaries. The upper Little Salmon River meanders through wide low-gradient meadows while the lower 24 miles flows through a more confined canyon, with a steeper gradient. The upper meadows are C channel types, while the lower canyon reaches are B channel types. The upper meadows area stretch of the river is able to access its floodplain and frequently overflows its banks during high flow periods.

The lower reaches of the Little Salmon River have high flushing flows during peak run-off. Flooding events in 1974, 1976 and 1997 contributed large amounts of mud and debris to the Little Salmon River. The majority of suspended sediment appears to be from natural causes (USFS 1995). The mainstem Little Salmon River has had severe flood damage scouring and riparian/flood plain degradation in the lower canyon reaches downriver from river mile 24 (BLM BA). The lower canyon river reaches are in a state of disequilibrium that the river adjusts to by reworking alluvial deposition and building new stream banks. The stream banks in the lower reaches have unstable sections which are primarily attributed to flood events.

The Little Salmon River is split into three assessment units on the 2002 303(d) list. These sections will be called the lower and upper (17060210SL007_04 and 17060210SL007_5) reaches for the purposes of this TMDL. The lower reach begins at Riggins where the Little Salmon enters into the Salmon River and extends up to the confluence with Round Valley Creek. The lower reach is approximately 24 miles long. Assessment unit 17060210SL007_05 of the Little Salmon extends from Round Valley Creek to approximately East Branch Goose Creek. Assessment units 17060210SL007_04, _03, and _02 comprise the assessment units of the Little Salmon River from East Branch Goose Creek to Mill Creek, Mill Creek to Vicks Creek, and Vicks Creek to the headwaters, respectively. Assessment units _03 and _02 are not on the 303(d) list.

The 1997 floods resulted in down cutting and lateral movement in the lower elevations of the river and loss of riparian vegetation. Portions of Highway 95 were completely washed out and many residences were partially or totally destroyed. Debris avalanches and slumps are evident throughout this section. As shown in Figure 17, the erosion hazard is high along the Little Salmon River from Round Valley Creek to Rattlesnake Creek.

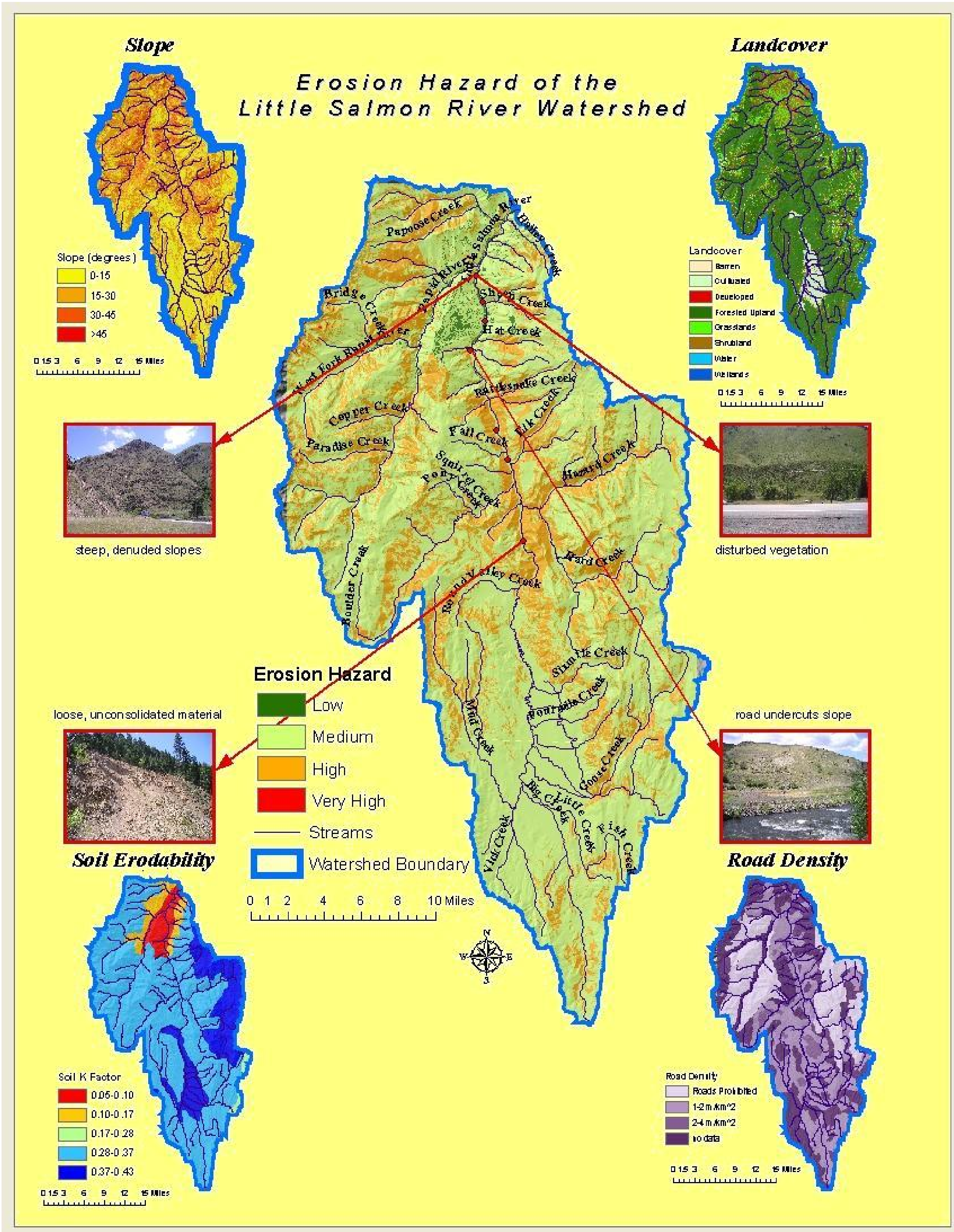

Figure 17. Mass Wasting Potential: Little Salmon River (DEQ 2005).

Temperature

During the summer, the upper reach has high water temperatures, which is suboptimal for salmonids. However, as the Little Salmon River flows towards the confluence with the Salmon River, the larger tributary streams contribute significant discharges of cooler water. These larger tributary streams include Hazard/Hard Creek, Boulder Creek, and Rapid River. Consequently, the mainstem Little Salmon River has cooler average water temperatures as it flows downstream towards the mouth. There are significantly more juvenile rainbow/steelhead below Hazard Creek than above it. Tributaries with cooler water, particularly larger ones create a localized cool water plume and mixing zone at the mouth of the creek. Cool water plumes or mixing zones at the mouth of tributary streams create important holding and rearing habitat in the Little Salmon River (BLM 2000).

As shown in Figure 18, temperatures in the Little Salmon River at the 45th parallel violate the state maximum daily average standard of 19 degrees Celsius. Temperatures in the Little Salmon River at Six Mile Creek (Figure 19)also had exceedances of the maximum daily average temperature standard, but the water was cooler than at the 45th parallel (June 21-September 22). This cooling effect in the Little Salmon River in the Meadows Valley is partly due to the influence of groundwater in the lower Meadows Valley. By the time the Little Salmon River reaches Riggins, temperatures are significantly cooler due to the input of cold water from Hazard Creek, Boulder Creek and Rapid River (Figure 20). Bull trout temperature criteria are not applicable in this reach due to the elevation (below the elevation that bull trout temperature criteria apply). Some results from 2005 are shown in Appendix C. These results, which are from the Little Salmon River near the 45th parallel, show violations of the state maximum daily average standard of 19 degrees Celsius.

A thermal infrared flyover was done in August 2004 during the low flow period to investigate temperature increases due to natural hot springs along the river corridor. The section of the Little Salmon River from Hazard Creek upstream to the headwaters was flown and photographed. The results did not show any hot springs influence in Meadows Valley. Zims Hot Springs probably does not have a thermal influence because the water is discharged from the swimming pool (where it is mixed with cold well water) into cooling ponds and then a 20 acre pasture separates the cooling pond from the Little Salmon River. There is no discrete channel leading from the cooling pond to the Little Salmon River, meaning that water reaches the river through subsurface flow which would result in further cooling. Other geothermal sources may have too small a discharge to affect the overall temperature of the Little Salmon River.

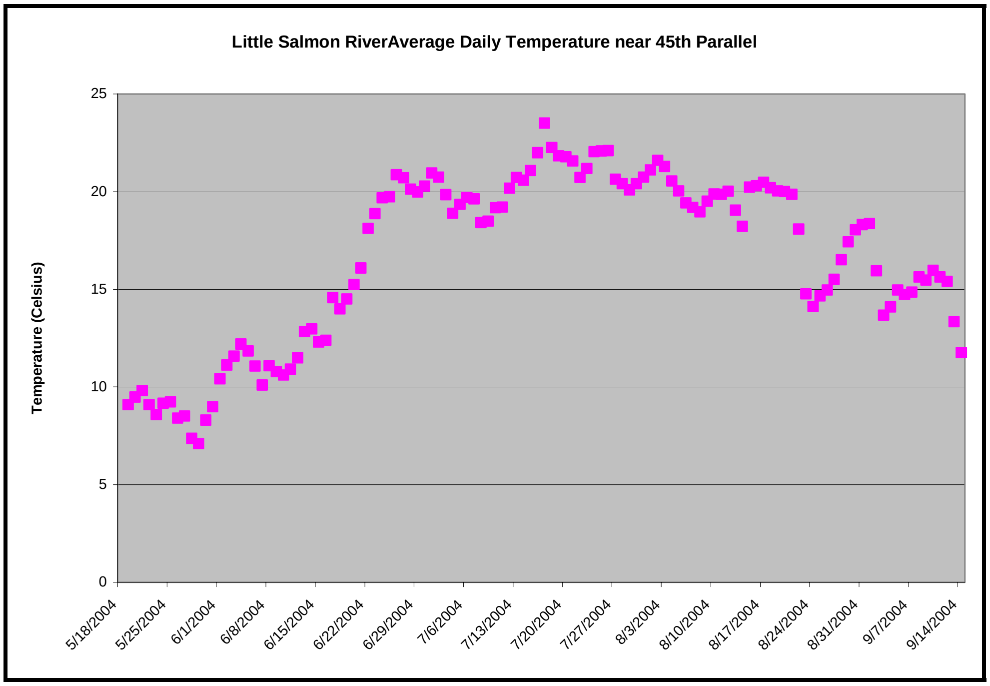

Figure 18. Little Salmon River Near 45th Parallel: Average Daily Temperature.

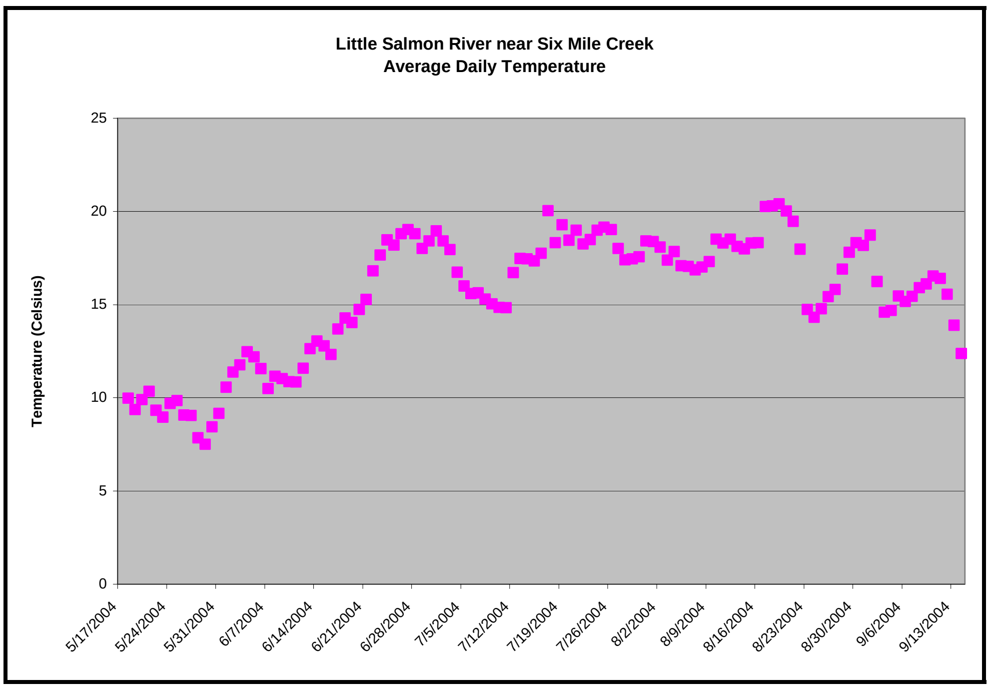

Figure 19. Little Salmon River Near Six Mile Creek: 2004 Average Daily Temperature.

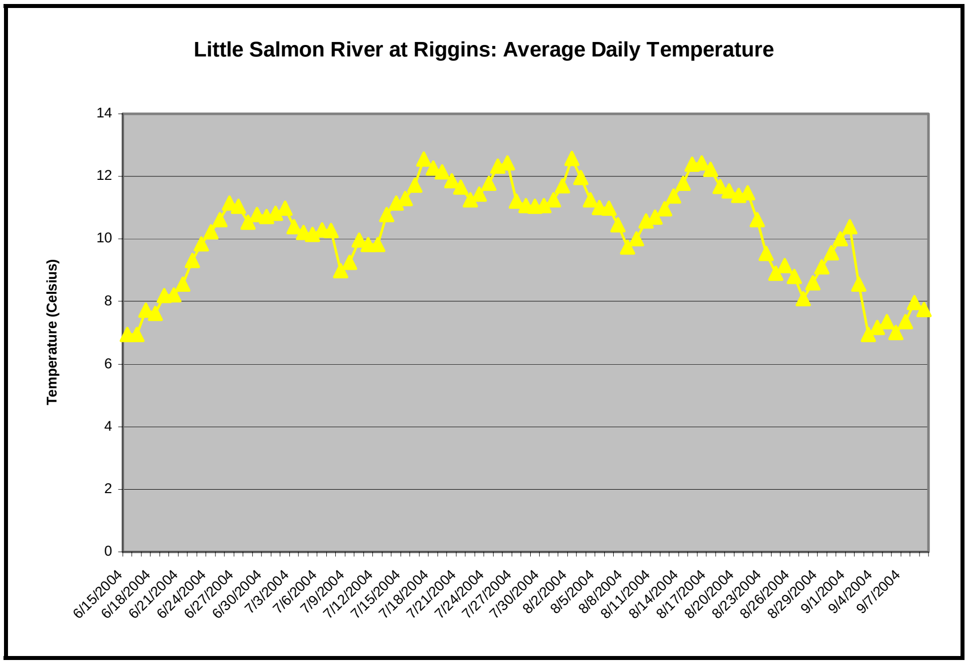

Figure 20. Little Salmon River at Riggins: Average Daily Temperature.

Fisheries

The Little Salmon River in the Meadows Valley reach has been stocked with rainbow trout by IDFG in the past. An IDFG fish survey in year 2000 found both rainbow and brook trout. The report notes that numerous nongame fish including Paiute sculpin, speckled dace and longnose sucker, were also caught. An IDFG fish survey in year 2005 found rainbow trout ranging from 170-400 mm in size, cutthroat (1 individual), brook trout, and whitefish.

The Little Salmon River downstream of the fish barriers has a limited occurrence of spring/summer Chinook salmon spawning and rearing as well as steelhead spawning and rearing. Mainly, the Little Salmon River is used as a migratory corridor. Populations of both these species are depressed throughout the Northwest region.

Other fish utilizing the mainstem Little Salmon River include rainbow trout, bull trout, whitefish, dace, sculpin, suckers, redside shiners, and pikeminnow.

The mainstem Little Salmon River downstream from river mile 24 has limited amounts of good Chinook salmon spawning habitat, due to the predominantly large sized substrate. The steeper stream gradient and high flushing flows do reduce sediment deposition, however, high discharge also "flushes" smaller sized suitable salmonid spawning gravels. Limited suitable gravels that do occur are primarily in deposition areas along the river margins or behind boulders.

Hydrology

A gaging station has been maintained at the mouth of the Little Salmon River since 1951. Mean annual streamflow recorded at the gaging station is 794 cubic feet per second (cfs). The mean monthly high flow (2,380 cfs) occurs in June while the mean monthly low flow

(225 cfs) occurs in September (USGS 1951-1998). On January 1, 1997, an extreme flood event (50 year flood) occurred in the Little Salmon River. The average flow for that day was estimated at 8,000 cfs with the flow peaking at 10,500 cfs. This was the second highest flow event monitored during the period of record. The extreme discharge event for the period of record occurred on June 17, 1974 (a 100-year flood). The average flow for that day was 9,650 cfs with the flow peaking at 12,500 cfs. The lowest daily flow was recorded on December 21, 1990 at 60 cfs. Figure 21 shows the average monthly flows at the mouth of the Little Salmon River.

Flood stage is considered to be 10 feet on the gage, and the Little Salmon River has been at flood stage nine times since 1948.

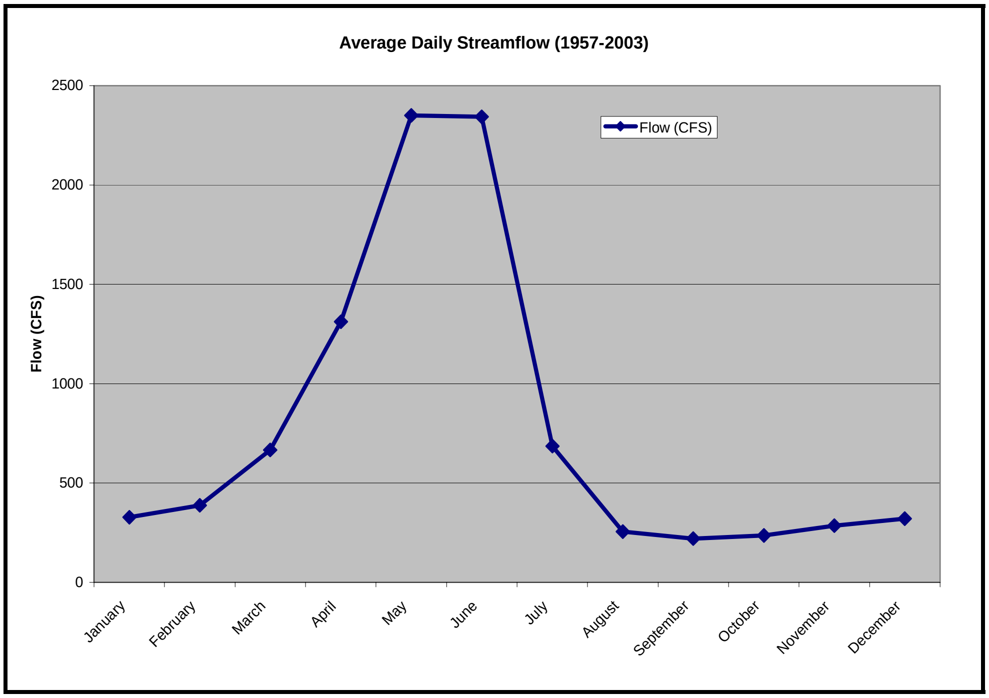

Figure 21. Little Salmon River Average Monthly Flow at Mouth (USGS).

Water Column Data

The Idaho Department of Agriculture monitored the Little Salmon River from April through October of 2004 and resumed monitoring in April of 2005. DEQ monitored periphyton in 2005. Results from 2005 were not available at the time this TMDL was written. In 2004, five sites were selected based on accessibility and locations that would best characterize sections of the river. Site LSR 1 is located at the mouth, site LSR 2 is located at White Bird Ridge Road Bridge at Indian Creek (downstream of Hazard and Boulder Creeks), site LSR 3 is located at the Circle C bridge upstream of Round Valley Creek and at the downstream end of Meadows Valley, site LSR 4 is located at the Old Highway Bridge in New Meadows and site LSR 5 is located at Carr Road at the upstream end of Meadows Valley (Figure 22). In 2005, monitoring focused on Meadows Valley and sites LSR 3 and LSR 4 were monitored as well as the Little Salmon River at Meadow Creek which is below the branches of Goose Creek. An agricultural drain near Four Mile Creek, Four Mile Creek, Little Creek, Mud Creek and

Big Creek were also monitored to determine what nutrient inputs are from tributary sources. Big Creek was also monitored in 2004.

Bacteria monitoring (Table 12) showed that the Little Salmon River at Circle C Bridge (LSR-3), the Little Salmon River at New Meadows (LSR-4) violated the state of Idaho bacteria standard. LSR-4 had particularly high levels of bacteria. This violation means that primary and secondary contact recreation uses are not supported. In other words, there is an increased chance of illness as a result of dermal contact or accidental ingestion of the water in these locations. The bacteria standard is < 126 *E. coli* organisms/100 mL as a 30 day geometric mean with a minimum of five samples and no sample > 406 *E. coli* organisms/100 mL. Recreational uses such as fishing and swimming take place in the Little Salmon River during the summer months when bacteria levels are high.

Table 12. Little Salmon River 2004 bacteria monitoring results.

Date	LSR-1 (E. coli organisms/100mL)	LSR-2 (E. coli organisms/100 mL)	LSR-3 (E. coli organisms/100 mL)	LSR-4 (E. coli organisms/100 mL)
6/29/2004	19	41	650	2400
7/8/2004	4	110	200	2400
7/13/2004	71	40	240	1400
7/19/2004	48	8	130	1600
7/22/2004	50	26	260	730
Geomean	26	33	254	1566

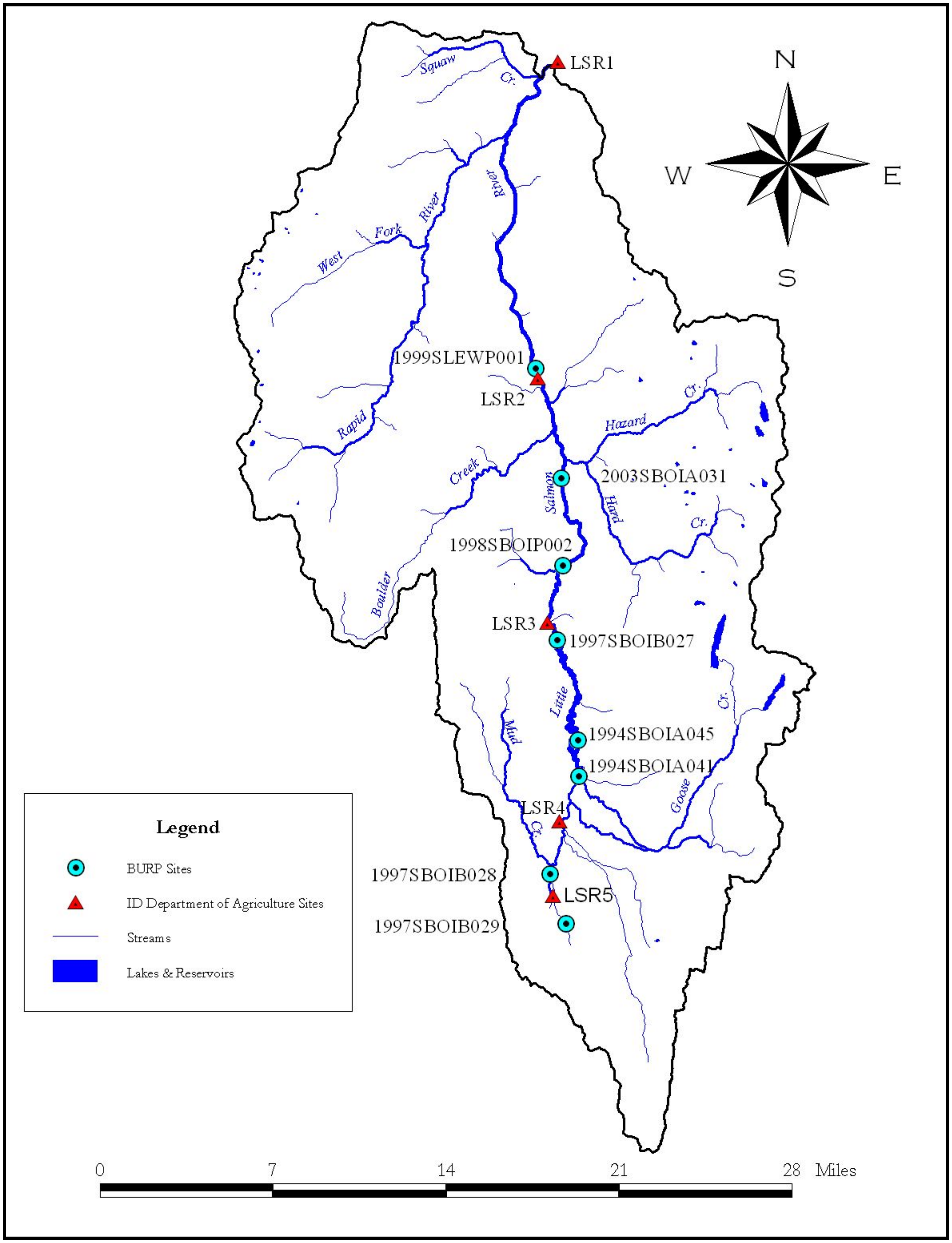

Figure 22. Little Salmon River Monitoring Sites.

Figure 23. Periphyton Present at Little Salmon River at New Meadows.

Nutrient monitoring showed that nutrient concentrations were low in the lower reach of the Little Salmon River (LSR 1 and LSR2) (see Appendix C for results). Elevated nutrient concentrations were seen at LSR 3 (LSR at Circle C Ranch) and LSR 4 (LSR at New Meadows), particularly from late July through August when flows decreased. This time period also coincided with the appearance of nuisance periphyton growth. Phosphorus concentrations were consistently lower at the downstream LSR3 site (Figure 24). The Idaho Department of Agriculture surmised that high levels of organic phosphorus found in the water quality analysis are from algal die off or periphyton sloughing off. Decreased concentrations downstream may be due to the use of phosphorus by periphyton or other algal species.

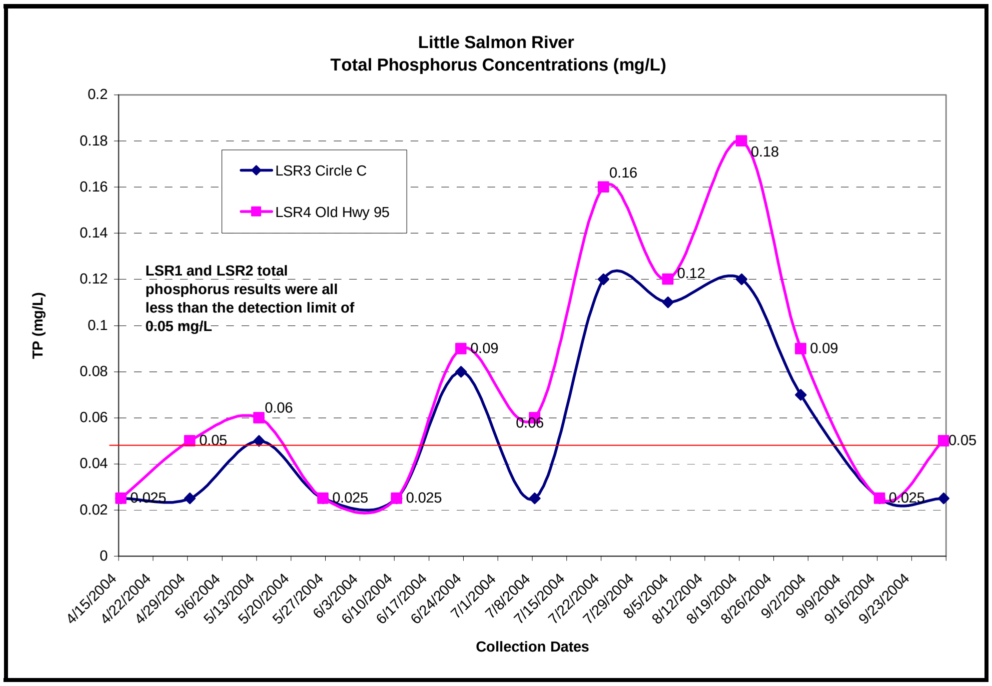

Figure 24. Little Salmon River: 2004 Total Phosphorus Concentrations.

Potential conditions for depressed dissolved oxygen were seen in August 2004 and periphyton growth was also seen at this time (Figure 23). These are indicators of nutrient impairment. In late July through mid August 2005, depressed dissolved oxygen concentrations (< 6 mg/L which is in violation of the state standard) were observed in the early morning hours, indicative of a diurnal sag. This means that during the day dissolved oxygen levels rise due to algal productivity but during the night dissolved oxygen is used up due to algal die-off and since photosynthesis is not taking place, this dissolved oxygen is not replaced. Low dissolved oxygen puts significant stress on fish and other aquatic organisms. Stream waters are especially vulnerable to depressed dissolved oxygen during times of warmer temperatures and high nutrient levels.

The results from the biweekly monitoring showed that the Little Salmon River was far below the 50 mg/L suspended sediment concentration target that has been used in many Idaho TMDLs as a target that will support cold water aquatic life including salmonid spawning (Figure 25). Several sampling dates took place either after or during rain events. Bedload sediment was not measured due to both lack of equipment and appropriate monitoring locations. In the Meadows Valley reach, it was surmised that since the predominant fraction of bank material is fine material, this would have been picked up in the samples during high flow events. Given that levels remained low even after rain events and high flows, in-stream channel erosion does not appear to be a contributor to excess sediment load during normal water years.

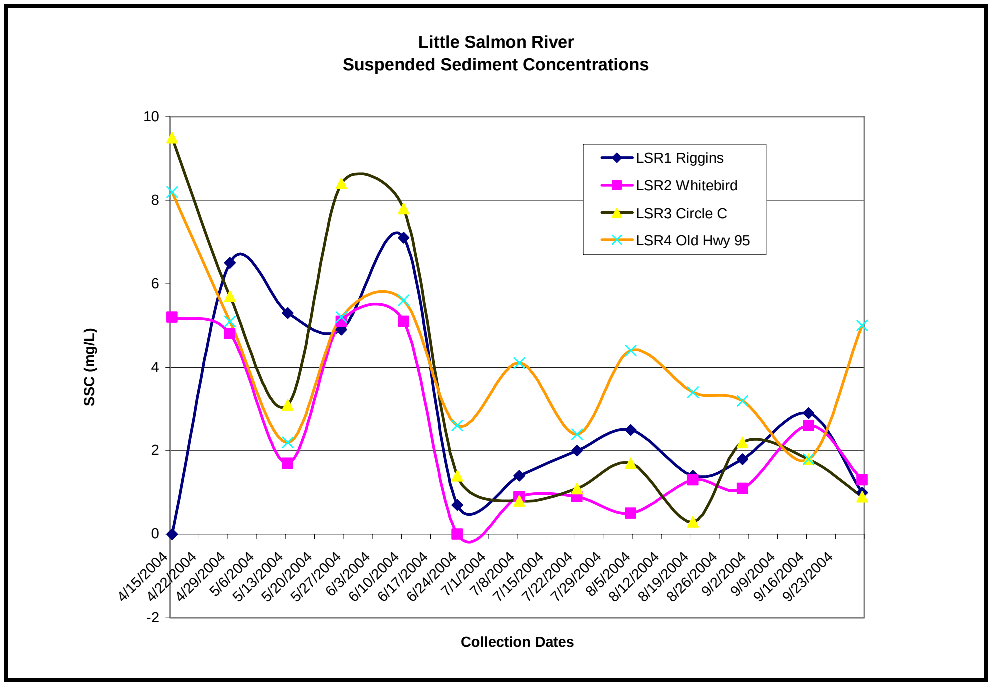

Figure 25. Little Salmon River: 2004 Suspended Sediment Concentrations.

Habitat Data

DEQ water body assessment data shows that beneficial uses are impaired in the section between Mill Creek and Round Valley Creek (Tables 13 and 14). The Stream Habitat Index (SHI) is calculated from a range of habitat inventory parameters including bank stability, riparian cover, percent surface fines, pool quality, large organic debris etc.) Scores range from 1-3, with 3 being the highest score. The Stream Macroinvertebrate Index (SMI) is calculated from nine macroinvertebrate metrics having to do with pollutant tolerance, species diversity, number of individuals, species distribution, etc. Scores range from the lowest which is below < minimum threshold, through the highest score of 3. The < minimum threshold score indicates an impaired aquatic environment and lack of beneficial use support. The Stream Fish Index (SFI) is also calculated from a range of fish metrics and the scores also range from < minimum through a high score of 3. 'NA' means that that the stream was not electrofished (NA= not assessed). Not all streams are electrofished, depending upon the safety conditions for electrofishing and whether or not a DEQ staffperson with an electrofishing permit is available to electrofish the stream with the stream inventory crew.

The SMI score at the Round Valley Site showed a Hilsenhoff Biotic Index (an index that relates to nutrient enrichment) score of 6.3. The index ranges from 1-10, with 1 being indicative of an environment with little to no nutrient enrichment and 10 being a heavily nutrient enriched environment. 6 is in the moderate nutrient enrichment range.

Water body assessment scores for the section below Round Valley Creek showed full support of beneficial uses.

Table 13. Little Salmon River: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
2003SBOIA031 (downstream of Round Valley Creek, 1 mile upstream of Hazard Creek)	1	2	3	2	Full Support
1997SBOIB028 (upper reach just below Mill Creek)	1	3	NA	2	Full Support
1997SBOIB027 (just upstream of Round Valley Creek)	1	1	NA	1	Not Full Support

Table 14. Little Salmon River: DEQ large river water body assessment scores.

DEQ Stream Site ID	RMI	RDI	RFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
1998RLEWP001 (LSR below Fall Creek)	3	1	NA	2	Full Support
1998RBOIP002 (LSR at Round Valley Creek)	2	1	NA	1.5	Not Full Support

Conclusions

DEQ water body assessment data showed that beneficial uses were impaired in the Little Salmon River below Mill Creek and above Round Valley Creek during the summer months. The Idaho Department of Agriculture conducted water quality monitoring to identify potential pollutants impairing beneficial uses. Elevated total phosphorus levels during low flow periods and violations of the state bacteria standard were shown in the results. The Little Salmon River does not meet Idaho water quality criteria for temperature or bacteria. Nutrient concentrations were also elevated during the summer months. More information on temperature and nutrient targets can be found in Section 5. TMDLs for temperature, bacteria, and nutrients were developed.

While habitat scores showed that the Little Salmon River below Round Valley Creek supported beneficial uses, this section is an important anadromous fishery. This section is listed for sediment and coarse sediment (bedload) is likely reducing spawning habitat in the river. Coarse sediment was transported during the 1997 flood and remains in the channel and side channels.

While DEQ was able to identify areas that were subject to mass wasting (Figure 19), separating out human caused factors from natural factors was not possible. At this time, DEQ plans to work with other agencies to not only identify areas of potential concern for erosion, but also those sections of channel that are currently aggraded and vulnerable to further loading

DEQ proposes to list the Little Salmon River below Round Valley Creek for habitat alteration. Historic highway construction is the main factor in the habitat alteration. It is imperative that any new construction or any other management activity not encroach upon the natural meander of the Little Salmon River. The state of Idaho's antidegradation policy states that the existing in stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

Mud Creek

Mud Creek, a second order stream, originates at 5,700 feet on Brush Mountain, flows in a southerly direction and enters the Little Salmon River approximately three miles southwest of New Meadows. Mud Creek drains approximately 20,608 acres. Little Mud and Middle Mud Creeks are tributaries to Mud Creek (Figure 26). The Mud Creek watershed comprises assessment units17060210SL008_02 and _03.

Geology

Mud Creek originates in Imnaha basalt and Grande Ronde basalt of the Weiser Embayment. Little Mud Creek originates in basalt but also runs through Idaho Batholith material. The lower elevations of Mud Creek flow through Quaternary alluvial deposits before entering the Little Salmon River.

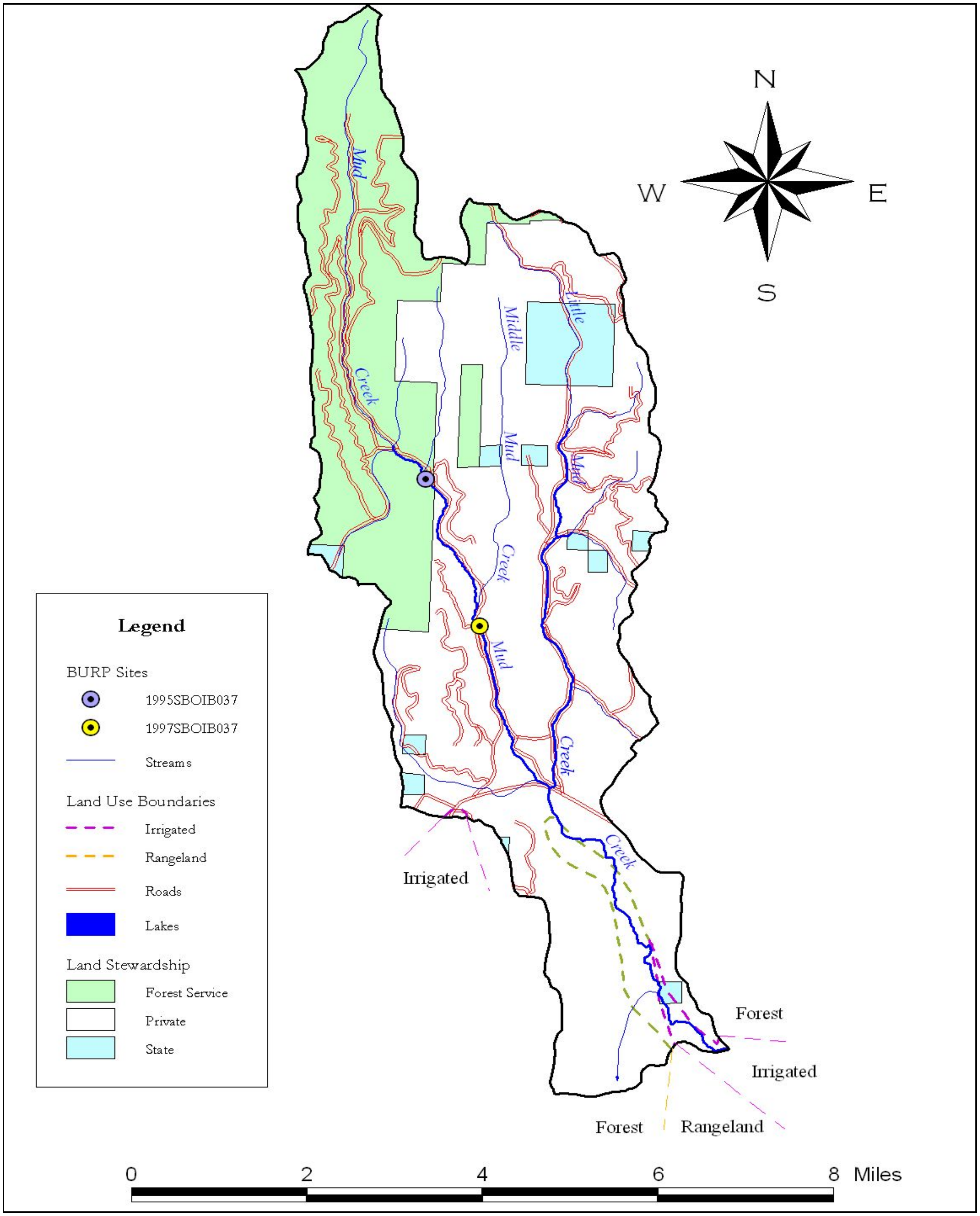

Figure 26. Mud Creek Subwatershed.

Vegetation

The watershed is primarily forested, but the lower reaches of Mud Creek and Little Mud Creek flow in a southerly direction through both range and pastureland.

Douglas fir, Englemann spruce, Grand fir, and lodgepole are the dominant species in the forested areas. The higher elevations have subalpine fir, larch, lodgepole pine and Douglas fir. Midstory vegetation consists of alder, willow, dogwood, and serviceberry with various forbs and grasses interspersed between the shrubs.

The lowest elevations are grasses and forbs. Willow and alder species are present within the riparian zone. The vegetative communities are affected by grazing pressure in these areas. Within the riparian zones of heavily grazed areas, sedges are dominant (USFS 1992a).

Land Use

Mud Creek is used for grazing, agriculture and is being developed residentially in its lower reaches. The upper reaches have been managed for grazing and timber harvest. Mud Creek is within the USFS Price Valley S&G grazing allotment. In 2004, the grazing permit was approved for two bands of 950 ewe/lamb pair to graze between June 6 and July 10.

Road densities within Mud Creek are 6.24 mile road/mile^2 in the upper area and 5.46 mile road/mile^2 in the lower areas. Thirty-three percent of the upper Mud Creek roads are within riparian conservation areas(RCAs), and 39% of the lower Mud Creek roads are within RCAs.

Hydrology

A moderately sinuous stream, Mud Creek is a Rosgen Stream Type (RST) C at the lower open meadow elevations (Figure 27). Within the middle elevations, Mud Creek has RST B characteristics. It is moderately sinuous, moderately confined, and has an average gradient of 5%. Above 4,760 feet in elevation, the RST is mostly RST A. The substrate changes to boulder with some granite outcroppings.

Gauging records for Mud Creek exist from 1946-1959. The stream follows a typical hydrologic regime for central Idaho. The peak flow occurs during mid-April to late-May and reaches base flow by late July (Figure 28).

Figure 27. Mud Creek (March 2005).

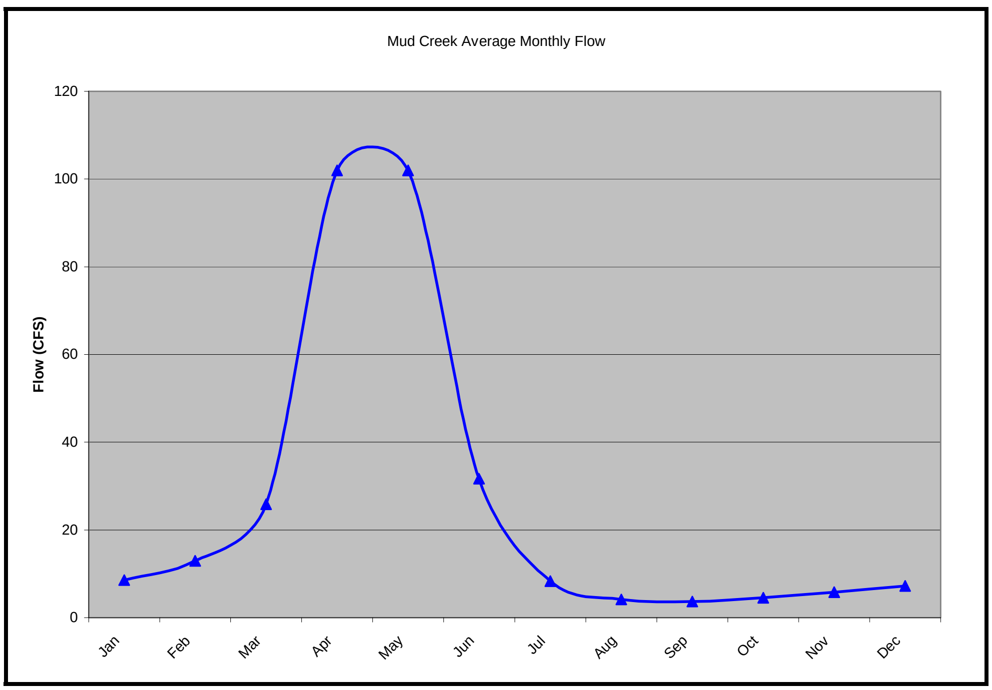

Figure 28. Mud Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Temperature

The Idaho Department of Fish and Game has monitored temperature in Mud Creek for several years below a riparian improvement project located at the Highway 95 crossing. The most recent data is presented below (Figure 29). Exceedances of the temperature standard comprised less than 10% of the summertime temperatures in 2005. 2004 results had exceedances comprising 11% of the summertime daily temperatures. In 2003, 29% of the summertime daily temperatures exceeded the average maximum daily standard and in 2002, 12% of the summertime daily temperatures exceeded the average maximum daily standard.

The USFS has measured in-stream temperatures higher up in the watershed near the 1995 BURP site (Figure 22), no exceedances of the 19 degrees Celsius average daily maximum temperature were seen at this site in 2004 or 2003.

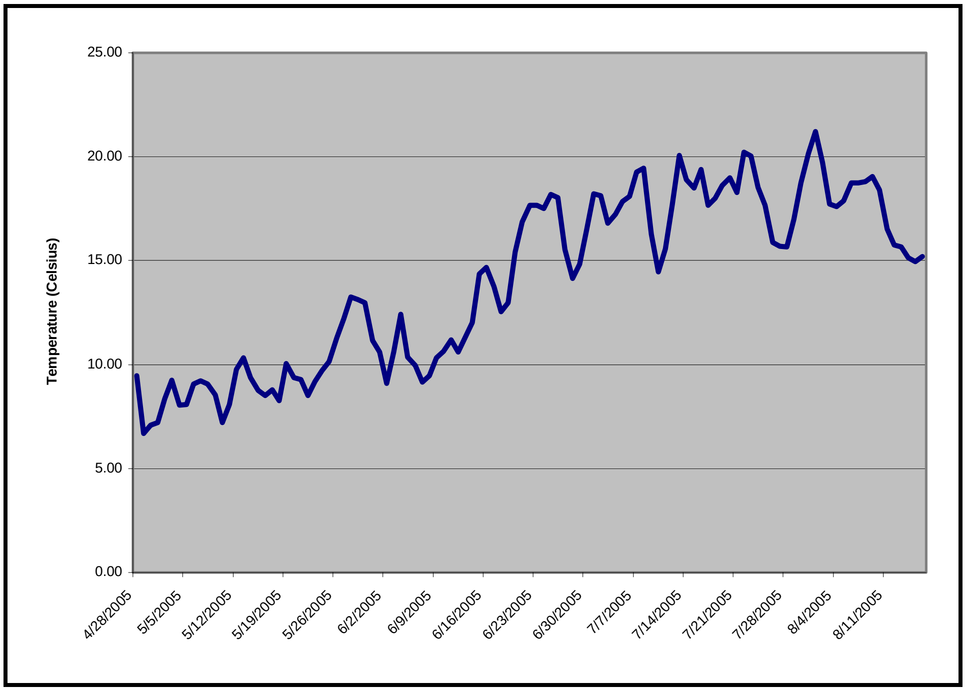

Figure 29. Mud Creek at Highway 95 Bridge: 2005 Average Daily Temperature.

Fisheries

Within Mud Creek, redband trout and brook trout are the only salmonid species that have been observed. The redband trout were small sized (110-120mm in length) while the brook trout ranged in size from under 50mm up to over 200mm in length. The proportion of fish species present was clearly dominated by brook trout with population numbers spanning various age classes.

Chinook salmon and steelhead are not observed within Mud Creek due to the falls on the Little Salmon River. Bull trout have not been observed within Mud Creek.

A 1997 BURP survey observed fresh water clams within the stream.

Habitat Data

1997 water body assessment scores (Table 15) indicate that beneficial uses are not impaired in Mud Creek near the confluence of Middle Mud Creek. This assessment encompasses the watershed above the confluence of Middle Mud Creek. The 1997 score supercedes the 1995 score which was taken upstream of that site.

Table 15. Mud Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
1997SBOIB037	3	3	Not Measured	3	Full Support
1995SBOIB037	1	2	Not Measured	1.5	Not Full Support

Mud Creek originates in volcanic parent material. According to Overton (1995), volcanic RST C channels have mean percent surface fines of 37%. Substrate monitoring provided by the USFS, has shown Mud Creek mean percent surface fines ranging from 3.4 to 23.7% over the past ten years. These values are below the Overton values for volcanic RST C. However, an IDFG survey in 2000 recorded percent surface fines as 100% in one transect of a low gradient RST C depositional reach.

A 1994 R1R4 fisheries habitat inventory performed by the Forest Service found bank stability functioning at risk. (USFS, unpublished data 1994). A 1992 PfanKuch Channel Stability Evaluation found the mainstem on forest service lands to be in generally fair condition. An IDFG fish survey in 2000 also noted degraded banks in Little Mud Creek. Preliminary data from the Idaho Department of Agriculture from close to the mouth of Mud Creek (Mud Creek at Highway 95) has shown very low amounts of suspended sediment, showing that runoff events are not causing excessive in-stream channel erosion. Sampling occurred after several rain events.

Preliminary data from a 2005 survey of Little Mud Creek at the confluence with Mud Creek indicated low flow (0.4 cfs in mid-July), moderately stable banks (82% stable) and high percent fines (67%). Macroinvertebrate information is not available as of the time of this writing. An assessment of benefical use support will not be completed until after the macroinvertebrate data is obtained.

Conclusions

Beneficial uses appear to be supported in the upper reaches of Mud Creek. The most recent data suggests that the temperature standard is met through the mainstem of Mud Creek from the headwaters to the mouth. The DEQ Waterbody Assessment Guidance allows for 10% of the measured temperatures to exceed the standard and still be indicative of supporting beneficial uses in a stream that is <u>not</u> on the 303(d) list. The status of beneficial use support in Little Mud Creek and Middle Mud Creek are not known. A BURP inventory was conducted in 2005 for Little Mud Creek but the data were unavailable at the time this report was written in order to make a beneficial use assessment. Mud Creek should continue to be monitored for temperature to keep track of trends in the temperature regime.

Big Creek

Big Creek originates south of the Little Salmon River at 6,600 feet on the east side of Blue Bunch Ridge (Figure 30). It flows north through forested and meadow areas, and enters the Little Salmon River about a mile southwest of New Meadows (approximately 41 miles upstream of the mouth of the Little Salmon River). The watershed drains 18,592 acres. Assessment unit 17060210SL009_02 comprises of the Big Creek watershed.

Geology

Big Creek originates in Columbia River basalt and then flows through alluvial/glacial deposits in the low gradient meadow areas of the lower reaches. A biotite gneiss/schist outcropping is present on the western slope of Big Creek just before the alluvial plain.

Soil types in the middle to upper elevations of Big Creek are cobbly-loam and have a moderate to very slow infiltration rate. The lowest elevations within the valley are loam-clay soil types. Infiltration and drainage in these soil types are slow and poor.

Land Use

The majority of Big Creek is privately owned with its headwaters within Forest Service, BLM, and state managed land (Figure 31).

In the middle to lower parts of the watershed, livestock grazing, irrigated pastures, hayfields and agriculture are the predominant land uses (Figure 31). The BLM Big Creek allotment allows 81 animal unit months (AUMs) of sheep to graze on BLM lands from June through October. Rural residential development also occurs in the lower watershed.

The upper part of the watershed is entirely forested and is actively managed for timber harvest (approximately 13,000 acres).

Figure 30. Big Creek (BC2, June 2003).

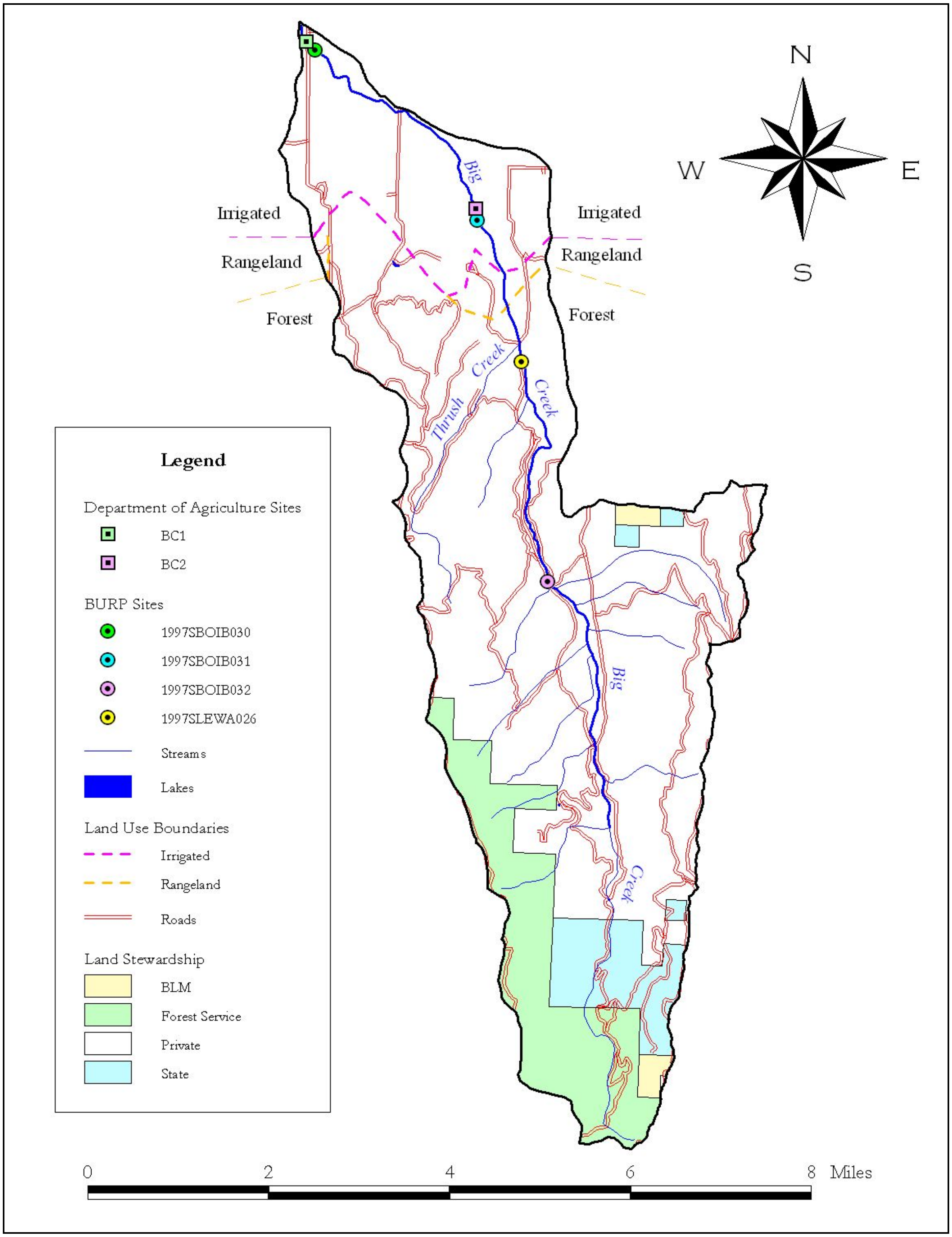

Figure 31. Big Creek Subwatershed.

Hydrology

The upper steeper, timbered reaches of Big Creek are Rosgen Stream Types (RST) A and B whereas the lower reaches in the meadow area is typically RST C with some RST B sections.

Big Creek hydrology follows typical central Idaho mountain flow regimes. The peak flow in this second order stream occurs from mid April to May, and low flows occur by late August and continue into the winter months (Figure 32). Stream order is a hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Higher order streams result from the joining of two streams of the same order.

Water is removed from Big Creek for irrigation of pastureland, and fluctuations in flows between BC1 and BC2 are likely attributable to water management. Figure 30 shows the location of BC1 and BC2 monitoring sites. Figure 31 shows the change in water flow between the BC1 and BC2 sites.

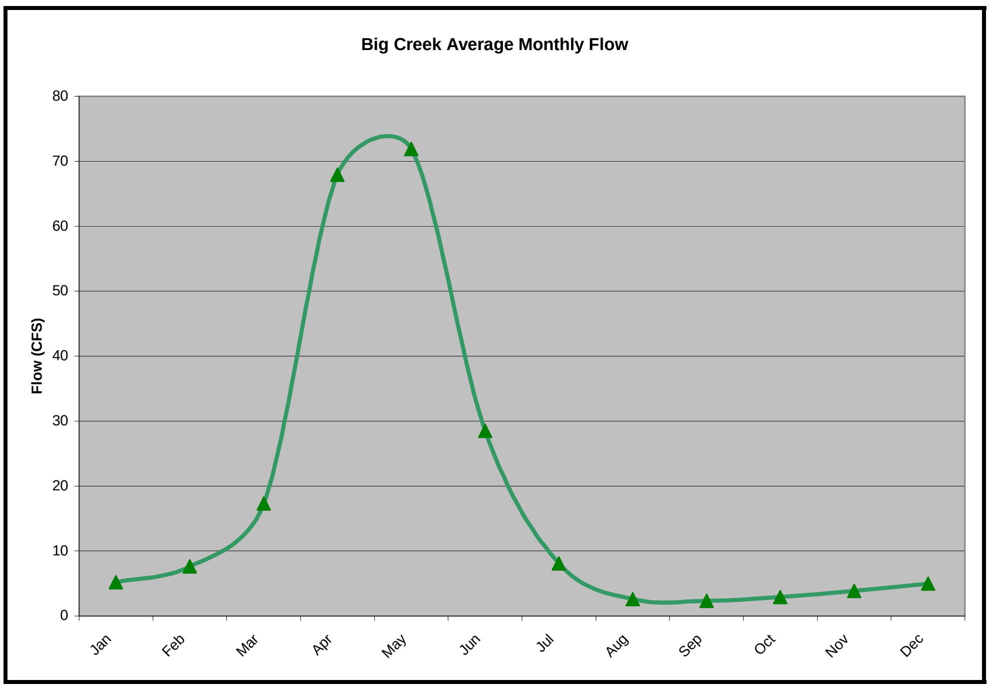

Figure 30. Big Creek Average Monthly Flows at Mouth (Estimated using StreamStat).

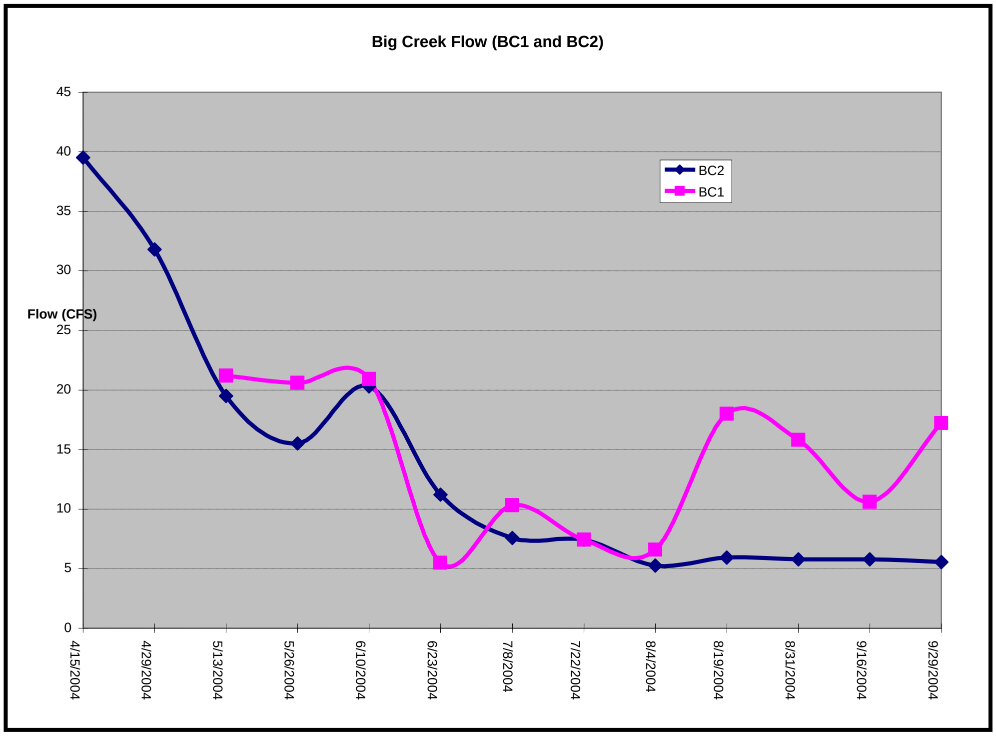

Figure 31. 2004 BC1 and BC2 Flows.

Fisheries

Cutthroat trout, brook trout and rainbow/redband trout have been documented within Big Creek. Chinook salmon and steelhead cannot access Big Creek due to the falls on the Little Salmon River. No bull trout have been documented within Big Creek.

A 1997 BURP survey observed longnose dace, speckled dace, and sculpin within Big Creek. A 2000 IDFG fish survey in the forested section of the watershed showed predominantly brook trout present in Big Creek.

Habitat Data

In the lower and middle watershed, impacts to the riparian area from grazing were assessed as moderate to severe (Ferguson 2001).

An Idaho Department of Lands Cumulative Watershed Effects study (IDL 2002) showed low surface erosion hazard and mass failure hazard ratings in the forested part of the watershed. Channel stability was evaluated as moderate. A road sediment delivery analysis indicated that sediment delivery from Forest Service roads was low. Road density for the Big Creek area is at 5.96 miles road/mile^2, 28% of which are within riparian conservation areas (RCAs). An RCA is a U.S. Forest Service description of land that lies within the following number of feet up-slope of each of the banks of a stream:

- 300 feet from perennial fish-bearing streams
- 150 feet from perennial non-fish-bearing streams
- 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.

1997 DEQ water body assessment scores showed that beneficial uses were not impaired in the forested reaches of Big Creek, but were impacted in the lower agricultural/rangeland reaches (Table 16).

The Hilsenhoff Biologic Index for stream sites 1997SBOIB030 and 1997SBOIB031 were 6.61 and 6.23 respectively, indicating moderate nutrient enrichment. This is a measurement of the macroinvertebrate community that is tolerant of nutrient enrichment.

Table 16. Big Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
1997SBOIB030	1	<min	1	<1	Not Full Support
1997SBOIB031	1	3	1	1.67	Not Full Support
1997SBOIB032	1	3	3	2.33	Full Support
1997SLEWA026	1	3	3	2.33	Full Support

Temperature

Both instantaneous and average daily temperature measurements show that Big Creek does not violate the water quality temperature criteria for cold water aquatic life (Figures 32 and 33). Figure 34 shows the temperature/time of measurement for most of the data points.

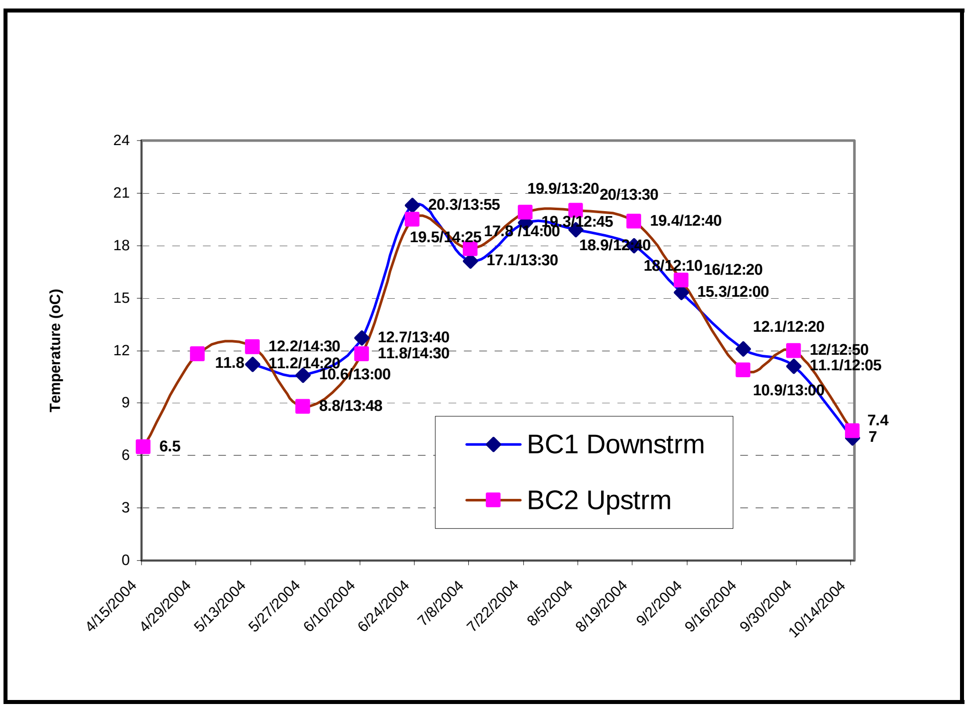

Figure 32. Big Creek: 2004 Instantaneous Temperatures.

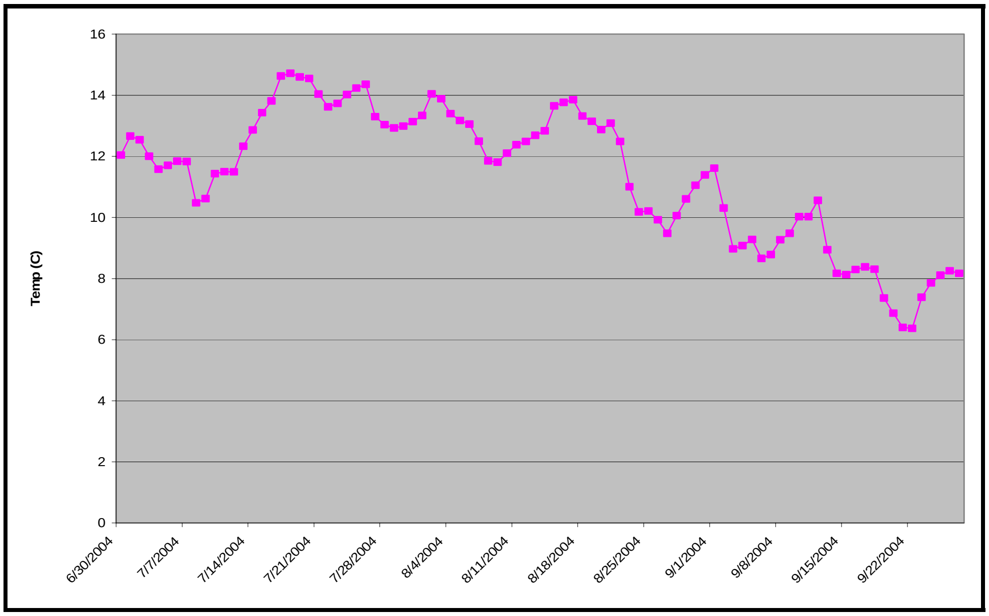

Figure 33. Big Creek In-stream Average Daily Temperatures (Upper Watershed).

Water Column Data

The Idaho Department of Agriculture monitored water quality in Big Creek in 2004. Total phosphorus concentrations were elevated, off and on, from the start of the monitoring season through August (Figure 34. Big Creek: 2004 Total Phosphorus Results.). Thereafter, a downward trend in in-stream nutrient concentrations was observed.

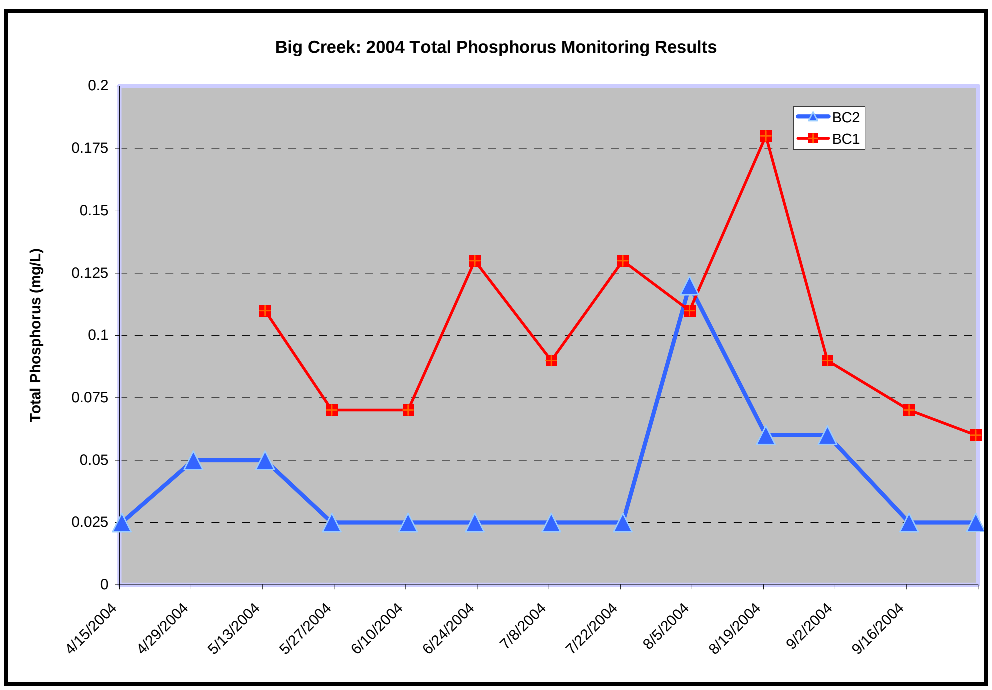

Figure 34. Big Creek: 2004 Total Phosphorus Results.

As shown in Table 17, the geometric mean for Big Creek and each individual concentration violate the state standard for bacteria. This violation means that primary and secondary contact recreation are not supported. In other words, there is an increased chance of illness as a result of contact of the skin with water or accidental ingestion of the water in these locations. The bacteria standard for primary contact recreation is < 126 *E. coli* organisms/100 mL as a 30 day geometric mean with a minimum of five samples and no sample > 406 *E. coli* organisms/100 ml. The bacteria standard for secondary contact recreation is less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days and no sample greater than 576 *E. coli*/100 ml.

Table 17. Big Creek bacteria results

Date	BC-1 (E. coli organisms/100 mL)
6/29/2004	**2400**
7/8/2004	**1400**
7/13/2004	**2400**
7/19/2004	**2400**
7/22/2004	**2400**
Geomean	2155

Conclusions

The Big Creek watershed was listed for an unknown pollutant after DEQ water body assessment scores showed that beneficial uses were impaired. Elevated nutrient and bacteria levels indicate that these are the most likely pollutants impairing beneficial uses. Stream surveys in the forested parts of the watershed showed no impairment of beneficial uses and a cumulative watershed effects survey showed that sediment is not being exported out of the upper reach at levels above natural background. A TMDL has been completed for Big Creek for nutrients and bacteria.

Goose Creek

Goose Creek (Figure 35 and Figure 36) originates above Goose Lake at 6,360 feet. Granite Mountain (elevation 8,478 feet) and Slab Butte (elevation 8,225 feet) flank the west and east sides of Goose Lake. Goose Creek flows south and west where it splits into the East Branch and the West Branch of Goose Creek. These two branches appear to be of natural origin. Both branches enter the Little Salmon River north of New Meadows, the East Branch at river mile 37.9 and the West Branch at river mile 38.8.

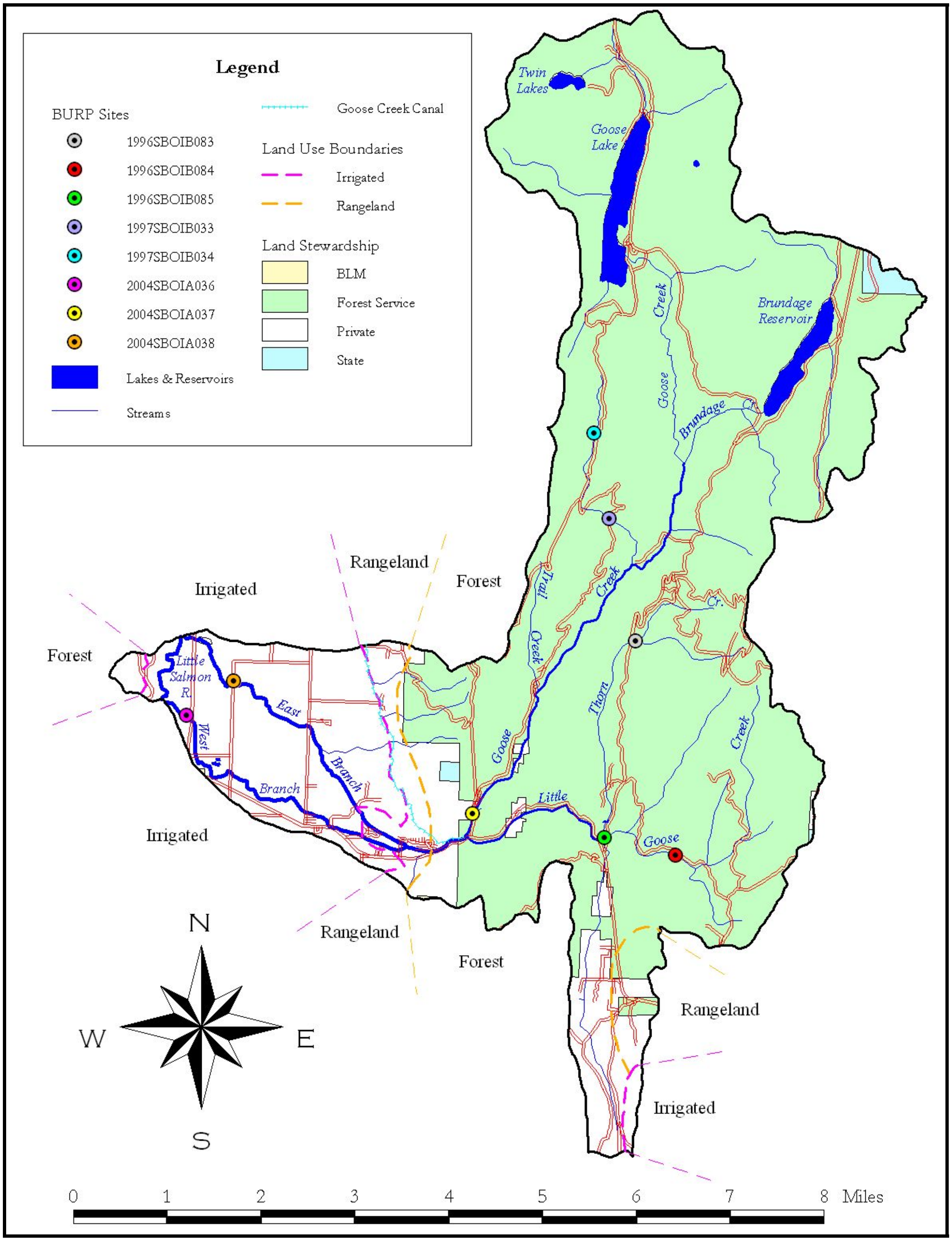

Figure 35. Goose Creek Subwatershed.

Figure 36. Goose Creek upstream of confluence with Little Goose Creek.

Geology

Starting in part of the Idaho Batholith, the stream flows through granitic parent material. Glaciers scoured the upper basin while various faults and large bedrock outcrops channelize the mid section of Goose Creek. Alluvial deposition shaped the lower elevations. The action of alluvial deposition may have formed the East and West Branches of Goose Creek. The sinuosity and apparent lack of channelization of each branch, along with substrate composition and riparian vegetation, make it appear that the branches are of natural origin (Olsen, personal comm. 2005).

Vegetation

Upland vegetation is predominately late seral stage with an overstory of coniferous species: Douglas fir, Englemann spruce, grand fir, and lodgepole. The higher elevations have subalpine fir, larch, lodgepole, whitebark pine and Douglas fir.

Mid-story vegetation consists of alder, willow, dogwood, and serviceberry with various forbs and grasses are interspersed between the shrubs. Mosses are present in the deep canyons (USFS 1996b).

The lower elevation valley consists of mature ponderosa pine forest with an understory of grasses and small shrubs. Further in the valley, riparian vegetation of willows and grasses are apparent on private agricultural lands.

Land Use

The headwaters are on Forest Service managed public lands while the lower sections are on private land, flowing through the town of Meadows and agricultural lands before entering the Little Salmon River.

Recreation is a primary use on public lands in the Goose Creek area. Last Chance campground and other dispersed campgrounds are present in the middle drainage. Around Goose Lake, campsites and off-road vehicle use is prevalent. Many roads crisscross the upper headwaters of the drainage.

Grazing occurs within the drainage on public and private land. Private land owners graze cattle, horses, and sheep on their land. The USFS Brundage S&G, Slab Butte S&G, and Meadows Valley C&H grazing allotments are within the Goose Creek watershed. The Brundage permit is split into a north unit and a south unit that joins with the Slab Butte permit. In 2004, the south Brundage and Slab Butte permit allowed 930 ewe/lamb pairs to graze between July 10 and September 21, while the north Brundage permit allowed 1700 dry ewes to graze between September 22 and October 15. The Meadows Valley permit allowed a total of 445 cow/calf pairs to graze between June 1 and September 30

Irrigation for agriculture also occurs and water for irrigation is stored in three reservoirs within the Goose Creek drainage. Twin Lakes and Goose Lake are directly on Goose Creek while Brundage Reservoir is on Brundage Creek, a tributary to Goose Creek. Much of the sediment produced in the higher elevations is trapped within these reservoirs (USFS 1996b).

Logging occurs extensively along the upper ridges of this area. Historic logging appeared to occur within riparian areas while more recent logging occurs high up the steep slopes. Many roads exist in the drainage from past logging. Some are still heavily used by ATVs, ORVs, and motorbikes (USFS 1996a).

Road densities are high within the watershed at 2.6 mi road/mile^2. Twenty-two percent of the roads are within riparian conservation areas (RCA) on USFS managed land. Little Goose Creek is a tributary to Goose Creek and has a road density of 6.83, and 18% of roads are within RCAs.

Hydrology

This fourth-order stream is steep with an average gradient of 4.5% until it enters Meadows Valley and becomes a very sinuous Rosgen Stream Type (RST) C. The upper reaches of Goose Creek fluctuate between high gradient RST A with an average gradient of 10-15% and lower gradient RST A-B with average gradients of 3-6%.

The peak high flow is not reached until late May, and the base low flow is reached in late August (Figure 37). The flow regime is regulated by three reservoirs resulting in unnaturally high flows later in the runoff season (USFS 1996b). Due to flow management, flows in East Branch and West Branch Goose Creek fluctuate, depending upon water needs. Little Goose Creek is a tributary to Goose Creek and runs alongside Highway 55. Bear Creek, an intermittent tributary to Little Goose Creek, drains the Rock Flat area.

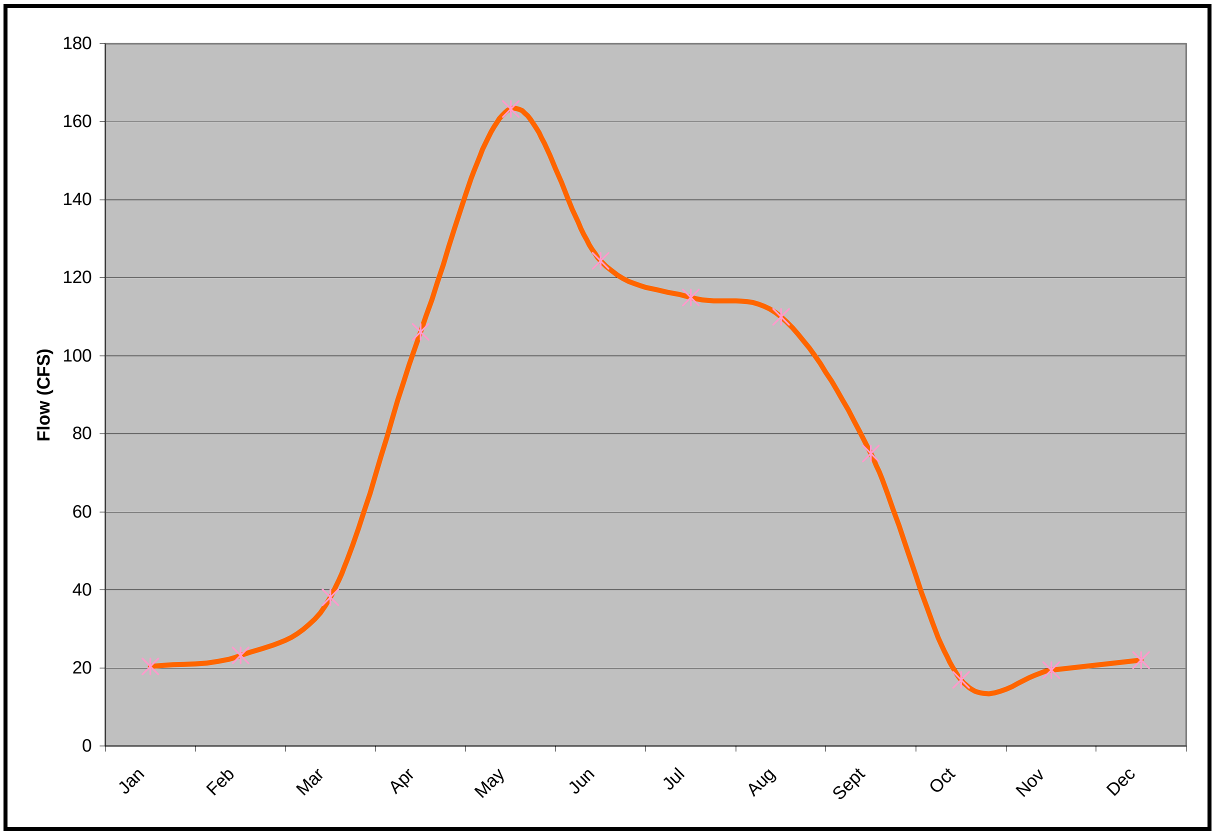

Figure 37. Goose Creek Average Monthly Flow at confluence of Little Goose Creek and Goose Creek (Estimated Using StreamStat).

Temperature

Goose Creek met the state water quality criteria for temperature during the summer months (Figure 38). The most recent temperature data is shown in this graph.

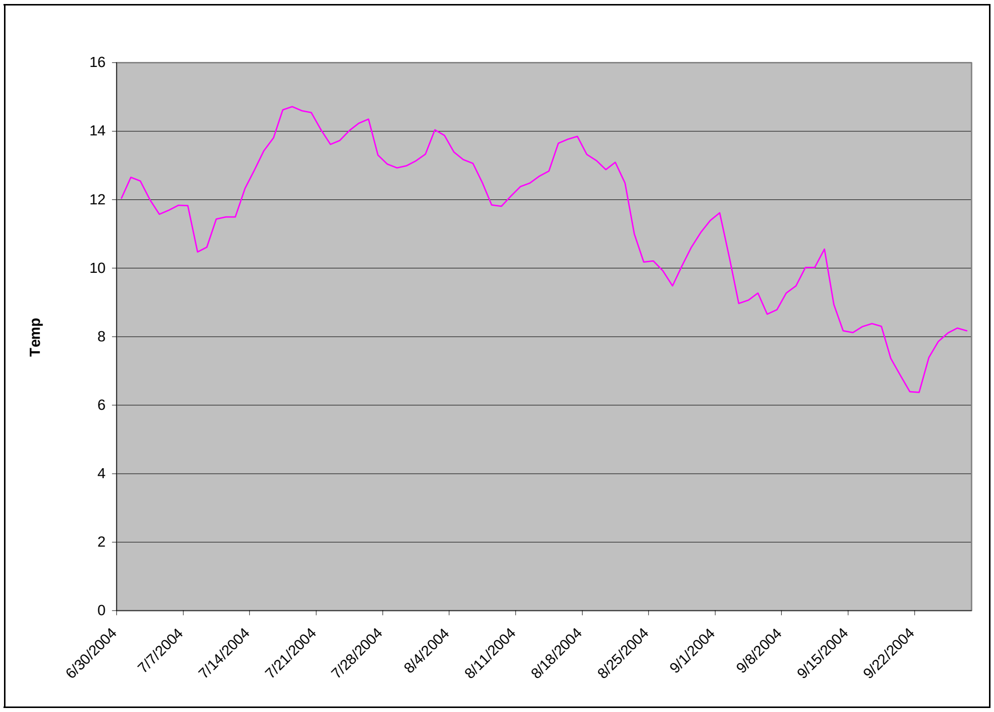

Figure 38. Summer Water Temperature in Goose Creek (USFS 2003).

Fisheries

Various fish species are present within Goose Creek. Redband, rainbow trout and brook trout have been observed. High gradients and large substrate in the upper elevations provide little fish habitat for juvenile fish. Goose Creek is upstream of the fish barrier falls on the Little Salmon River and, therefore, supports only resident populations of fish. Past stocking of trout in the lakes and reservoirs also may contribute to fish populations. Lower West and East Branch Goose Creek contain speckled dace and sculpin. Little Goose Creek contains brook trout and rainbow trout. An IDFG fish survey in 2000 found a variety of age classes of rainbow trout including young of the year in Little Goose Creek (IDFG 2001).

Chinook salmon and steelhead are not observed within Goose Creek due to the falls on the Little Salmon River, a fish passage barrier. However, Nez Perce elders have stated that anadromous fish were fished historically in Goose Creek. As part of the Nez Perce oral tradition, these reports may date back to the late 1800s. Bull trout have not been observed within Goose Creek.

Habitat Data

The beneficial uses in the forested sections of Goose Creek are considered not impaired according to 1997 BURP data (Table 18). 2004 BURP inventories conducted near the mouth of the East Branch of Goose Creek showed that beneficial uses were not fully supported. The West Branch of Goose Creek was only at 0.4 cfs in early July and because the flow was less than 1 cfs could not be assessed. Beneficial use impairment in these branches may be partially attributable to very low flow conditions. Water management results in fluctuating flows in both channels.

Table 18. Goose Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
2004SBOIA36 (West Branch Goose Creek)	NA	NA	NA	NA	Not Assessed Due to Low Flow
2004SBOIA38 (East Branch Goose Creek)	1	Data Not Yet Available	<minimum	<minimum	Not Full Support
1996SBOIB083 Thorn Creek	3	-	3	3	Full Support
1996SBOIB084 Little Goose Cr (upper)	3	1	3	2.33	Full Support
1996SBOIB085 Little Goose Cr (lower)	2	1	2	1.67	Not Full Support
1997SBOIB033 Seawell Creek (lower)	3	-	3	3	Full Support
1997SBOIB034 Seawell Creek (upper)	2	-	3	2.5	Full Support

The channel condition risk rating (<15% ECA to reduce the risk of peak flows and subsequent channel instabilities) is low in the upper Goose Creek drainage and moderate in the lower and Little Goose Creek drainages (USFS 2004b).

Goose Creek originates in plutonic parent material. According to Overton (1995), plutonic RST A, B, and C have mean percent surface fines of 26, 23, and 37% respectively. Substrate monitoring of Goose Creek within all three RSTs show mean percent, surface fines of 1.4 to 18.5%. These values are below the Overton guidelines for plutonic streams. The Little Goose Creek watershed had percent fines greater than 20% in several reaches but the overall average percent fines was equal to 20%. Due to the proximity of lower Little Goose Creek to

Highway 55 for part of its length, sections of Little Goose Creek may have excess sediment delivered due to road sanding activities. Thorn Creek, a tributary to Little Goose Creek, had surface fines over 20%.

Data show that almost all reaches had >90% stable stream banks on USFS managed land.

Width-to-maximum-depth ratio, bank stability, and large woody debris for Goose Creek were considered functioning appropriately according to a 1996 R1R4 Fisheries Habitat Survey.

Conclusions

The beneficial uses in the forested portions of Goose Creek are not impaired. The East branch of Goose Creek does not support beneficial uses. DEQ recommends listing the fourth -order section of Goose Creek for an unknown pollutant and characterizing the flows to determine if fluctuating flows are impacting beneficial uses.

Brundage Reservoir

Brundage Reservoir is a 270 acre reservoir used for irrigation located at 6,238 feet in the Goose Creek watershed. It receives water from Brundage Creek, a tributary to Goose Creek. The reservoir is bordered by Brundage Mountain (elevation 7,802 feet) on the south and an unnamed peak (elevation 7,677 feet) on the north.

The USFS holds a 500 acre-foot water right for fish and wildlife habitat with the designated beneficial use being for recreational storage. Originally built as a Works Project Administration project in 1936, the current dam (the original was replaced in 1987) is 92 feet long, 63 feet high and has a capacity of 7,330 acre-feet. The reservoir typically fills between late May and early July with water releases starting in late June and continuing through early September. At full pool, the maximum release is 291 cfs and this release comes out from the bottom of the dam.

Geology

Brundage Reservoir lies in the Idaho Batholith and the surrounding area consists of heavily glaciated lands.

Land Use

Brundage Reservoir is a popular recreation destination. A developed handicap accessible fishing dock is located near the outlet. Many dispersed campsites and hiking trails exist. Motorized boats and off road vehicle use is prevalent. The reservoir is managed as trophy trout fishery. In winter months, the area is a popular snowmobile and backcountry ski destination. A Brundage Mountain Ski Area snowcat skiing route is located within the southern end of the watershed.

The Brundage Reservoir watershed is within the USFS Brundage S&G grazing allotment. The Brundage permit is split into a north unit and a south unit that joins with the Slab Butte permit. In 2004, the south Brundage and Slab Butte permit allowed 930 ewe/lamb pairs to graze between July 10 and September 21, while the north Brundage permit allowed 1700 dry ewes to graze between September 22 and October 15.

Much of the watershed was logged between 1940 and1960. The Brundage Water Users Association operates the dam for irrigation purposes.

Fisheries

Brundage Reservoir is managed as a trophy trout fishery and has been stocked with hatchery rainbow, cutthroat and kamloops trout.

Habitat Data

A 1996 Forest Service survey of the outlet creek from Brundage Reservoir found percent fines of 3.4% and bank stability at 99.3% stable (USFS 1996a).

Temperature

Temperature profiles taken in mid-July and mid-August during 2004 showed an average water column temperature of 14.5 degrees Celsius and 18.96 degrees Celsius, respectively. These profiles were taken near the dam and no single measurement exceeded the cold water temperature criteria. Temperature profile measurements taken weekly July through mid-August in 2005 (Appendix C) also showed no exceedances of the coldwater temperature criteria. Measurements were generally taken between 2 and 7 pm in order to measure temperature during the times when the water would be at the warmest for the day.

Conclusions

In 2004 and 2005, Brundage Reservoir did not violate cold water temperature criteria. Brundage Reservoir is proposed for delisting for temperature.

Six Mile Creek/ Four Mile Creek/ Three Mile Creek

Six Mile, Four Mile and Three Mile Creeks enter the Little Salmon River approximately 32-35 miles above the mouth of the Little Salmon River. Six Mile Creek, a second order stream, originates at an elevation of 7,300 feet. The Six Mile Creek drainage comprises assessment unit 17060210SL013_02. Four Mile Creek, a first order stream, originates at an elevation of 7,260 feet and is in assessment unit 17060210SL007_02, which also includes Three Mile and Martin Creeks. Three Mile Creek, a second order stream, originates at an elevation of 6,900 feet. These creeks originate in V-shaped valleys and flow west, entering a U-shaped valley in the middle reaches and eventually flows into the Meadow Valley floor.

Geology

These creeks originate in Imnaha basalt of the Weiser Embayment but also flow through Idaho Batholith and some volcanics. The lowest elevations flow through alluvial deposits within Meadows Valley.

Land Use

Six Mile Creek, Four Mile Creek, and Three Mile Creek, are separate tributaries to the Little Salmon River. The headwaters of these creeks are within Forest Service lands, and the lower reaches are in private ownership. Timber harvest exists on both public and private lands.

Cattle grazing occurs on both private and public lands. The USFS Meadows Valley C&H grazing allotment extends from Six Mile Creek down to Goose Creek. In 2004, 445 cow/calf pairs were permitted to graze public land between June 6 and September 30. The USFS Brown Creek grazing allotment is within the Six Mile watershed and allowed 235 cow/calf pairs to graze between August 7 and September 30.

Roads within these subwatersheds are at a density of 3.58 mi road/mile^2, and 20% of these roads are within RCAs. Within the Three Mile Creek watershed, old log skid roads are parallel to and within the stream bed. Road/stream crossings within the steep gradient sections have created possible fish passage barriers. The culvert at the crossing of Forest Service Road 303 is a significant fish barrier at low flows.

Recreation mainly consists of hunting in the late fall and ATV use on the roads. A gravel pit exists within the upper area of the Three Mile Creek drainage but does not appear to have been used recently. Old diversions and ditches exist within the middle and lower watershed of Three Mile Creek.

Vegetation

Riparian vegetation consists of ferns, mosses, currant, cottonwood, hawthorn, huckleberry, alder, dogwood, and Rocky Mountain maple. Spruce, Douglas and grand fir are also present and large in size. Upland slopes have a ponderosa pine overstory with arrowleaf balsam root and grasses for a sparse understory. Upland ridgelines have larch and subalpine fir present. The lower elevations areas are predominately pastureland (USFS 2004a).

Hydrology

All these creeks exhibit confined channels in the upper sections and flow westerly onto the meadow floor where Rosgen Stream Type (RST) B/C channels exist. Deep V-shaped channels are tucked between gentle sloping uplands. These streams are predominately RST B channels with sections of steep RST A/A+ within the upper elevations. Casual observations show Three Mile and Four Mile Creeks to be intermittent below the diversions. Six Mile Creek also exhibits low flows near the mouth. StreamStat analysis shows that without flow alteration, Three Mile Creek at the mouth would naturally have flows below 1 cfs during the period from July-February and that base flow would be 0.18 cfs. Four Mile and Martin Creek would likely be similar to Three Mile Creek. Idaho Department of Agriculture flow data for Four Mile Creek showed flows of 0.41 cfs on July 12, 2005 and 1.15 cfs on July 26, 2005.

Flows in these creeks fluctuate due to agricultural diversion activity. If Six Mile Creek did not have flow alteration, it would have flows at the mouth below 1 cfs during August and September with base flow at 0.79 cfs.

Temperature

Temperature in the forested reaches of Six Mile Creek met the state water quality criteria (Figure 39).

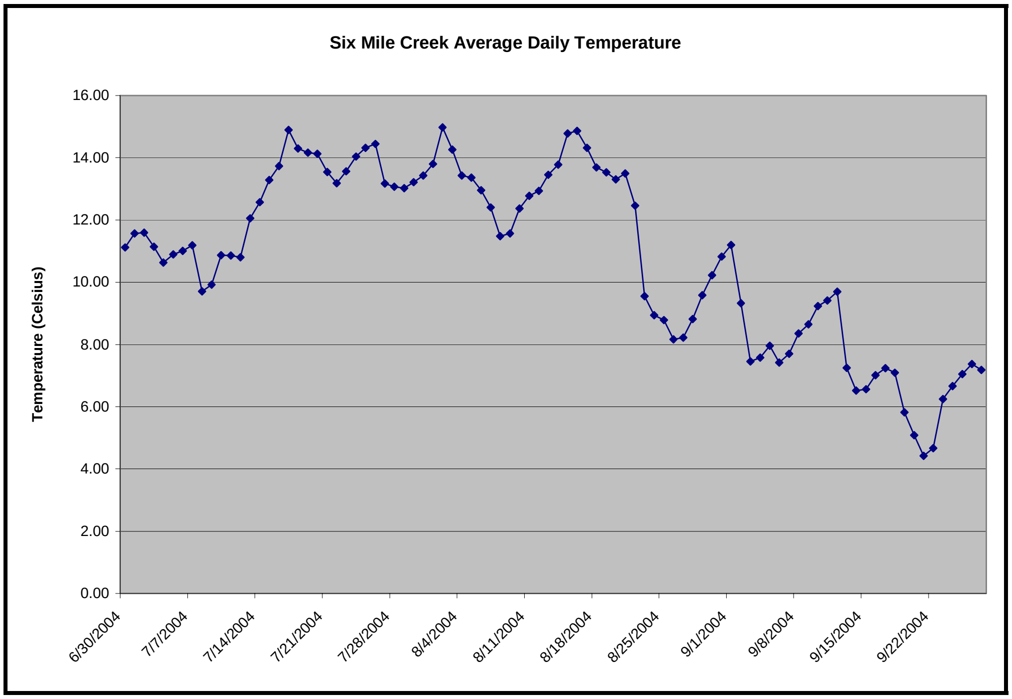

Figure 39. Six Mile Creek Temperature Data (USFS 2004).

Figure 40. Six Mile Creek (July 2004-Lower Reach).

Habitat Data

Six Mile Creek

Six Mile Creek originates in volcanic and plutonic parent material. The substrate was boulder/bedrock within the Rosgen Stream Type (RST) A and boulder/cobble/gravel within the RST B. According to Overton (1995), plutonic RST A and B have mean percent surface fines of 26 and 23% respectively, while volcanic RST A and B have mean percent surface fines of 25 and 27% respectively. A 2003 Forest Service survey of Six Mile Creek showed percent fines of 2.5 to 21% within RST A and B. A 2004 DEQ stream inventory in the lower reaches of Six Mile Creek showed an average mean percent fines value of 11%. These values are below the Overton values for both plutonic and volcanic RST A and B.

Large woody debris was abundant within the RST B and appeared to trap sediment upstream.

Large pools as well as overall pool frequency met the USFS environmental baseline desired condition (USFS 2004). The 2004 DEQ inventory showed >98% stable banks throughout the sampled reach. Bank stability ranged from 80 to 99% over six reaches surveyed by USFS personnel in 2002. A 1996 PfanKuch Channel Stability Evaluation found most of the mainstem of Six mile Creek on forest service lands to be in good condition. One small section was documented to be in fair condition due to flood damage.

While the final water body assessment score is not yet available for Six Mile Creek, the preliminary habitat and fish data indicate that beneficial uses are supported (Table 19). This monitoring site was in the lower reaches of Six Mile Creek (**Figure** 41).

Table 19. Six Mile Creek: DEQ water body assessment score.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
2004SBOIA35	3	NA	2	NA	NA

Four Mile Creek

In 2002 the Forest Service surveyed two miles of Four Mile Creek within Forest Service lands (Figure 41). The substrate in Four Mile Creek varied between the reaches. Gravels, fines and cobbles were present in the lower gradient reaches changing to large boulder and bedrock present in higher gradient reaches. Surface fines were determined to be at USFS target levels on USFS managed lands (USFS 2004). Large woody debris and pool frequency was also determined to be at USFS target levels. A 2004 PfanKuch Channel Stability Evaluation found the mainstem of Four Mile Creek on forest service lands to be in good condition. An IDFG fish survey of Four Mile Creek noted low bank stability (IDFG 2004). Overall stream banks appear to be stable with some isolated unstable locations.

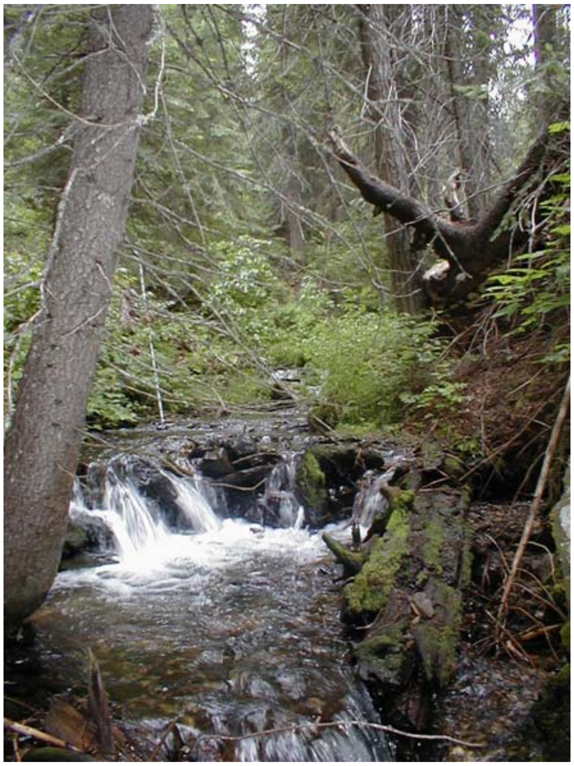

Figure 41. Four Mile Creek (2003 on USFS Land).

Three Mile Creek

Three Mile Creek was surveyed by the USFS in 2002 (Figure 42). The section of stream surveyed began at the forest service boundary and ended approximately 1.5 miles upstream at the road 303 crossing. The streambed is moderately confined and meanders slightly in the lower reach. The middle reach streambed has extensive braiding and many side channels throughout. The upper reach is very confined with few side channels. The reaches surveyed were RST B while above the survey area RST A existed. Long runs of fast water and small pools are characteristic of Three Mile Creek. Some small seeps and springs contribute to stream flow.

The substrate of Three Mile Creek increases in size as elevation increases. Within the lower reach, the substrate is predominately gravel to fines typical of grazed meadow streams. The middle reach is mostly small cobble and gravels with lots of fines within the pools, while the upper reach has large cobble and small boulder with fines in the pools.

The large woody debris exists mostly across the streambed but not necessarily within the stream channel. Most of the woody debris was aggregates of branches, live alder, and dogwood, and a few large logs that appeared to be placed as bank stabilizers decades ago. Bank stability varied from very low (< 65%) with active erosion prevalent to stable or solid rock bank. A 2003 PfanKuch Channel Stability Evaluation found the mainstem of Threemile mile Creek on forest service lands to be in fair condition.

An irrigation ditch which originates within the Forest Service boundary was leaking and creating a gully down the slope, causing erosion problems. In 2003, this ditch was fixed and the erosive action was stopped.

Figure 42. Three Mile Creek (Summer 2002).

Fisheries

Six Mile, Four Mile and Three Mile Creeks are upstream of the barrier falls on the Little Salmon River. Bull trout have not been observed within these creeks.

A 2000 IDFG fish survey in Four Mile Creek found that fish present were primarily redband trout and brook trout, all under 200mm in length (IDFG 2001). USFS fish surveys have also found redband trout. Fish barriers were found at two USFS road crossings. A DEQ BURP survey in 2004 found the RST C channel of Six Mile Creek, below the Goose Creek Canal had sculpin, rainbow trout and brook trout.

Martin Creek has multiple road crossings, and the results of a culvert inventory showed that most of the culverts are fish barriers. The USFS road crossings on Three Mile Creek have also been shown to be potential fish barriers due to the culvert placement.

Conclusions

Overall, beneficial uses appear to be unimpaired throughout the forested sections of Six Mile, Four Mile and Three Mile Creek watershed. A beneficial use support status call cannot be made on the lower sections of these creeks due to lack of information. Although a BURP inventory was conducted on a lower reach of Six Mile Creek, this information may not be applicable to Four Mile and Three Mile creeks due to differences in the flow regimes and habitat. Additional data were not collected for this TMDL report because these creeks were not on the 303(d) list.

Round Valley Creek

Round Valley Creek (**Figure** 43) is upriver of the Little Salmon River barriers and flows into the Little Salmon River at river mile 25.3. It is a third order stream which originates on the eastern slopes of Brush Mountain, elevation 6,247 feet. The lower reach meanders through meadows in wide valley bottoms.

Figure 43. Round Valley Creek.

Land Use

Primary land uses in the lower reaches of these creeks are irrigated pastures, hay fields, livestock grazing, and residences. Increased home development and subdivisions have also occurred in this drainage and as a result grazing has decreased somewhat. In the uplands impacts are mainly due to logging and roads.

The USFS Round Valley C&H grazing allotment is located on public lands within Round Valley and Trail Creek watersheds. In 2004, the Round Valley grazing allotment allowed 110 cow/calf pairs to graze public land between June 15 and August 1.

Hydrology

This low gradient stream has primarily RST C and B flowing through meadows in the lower reaches while the upper reaches are more timbered and steeper gradient. Figure 44 shows the estimated average monthly flow at the mouth of Round Valley Creek.

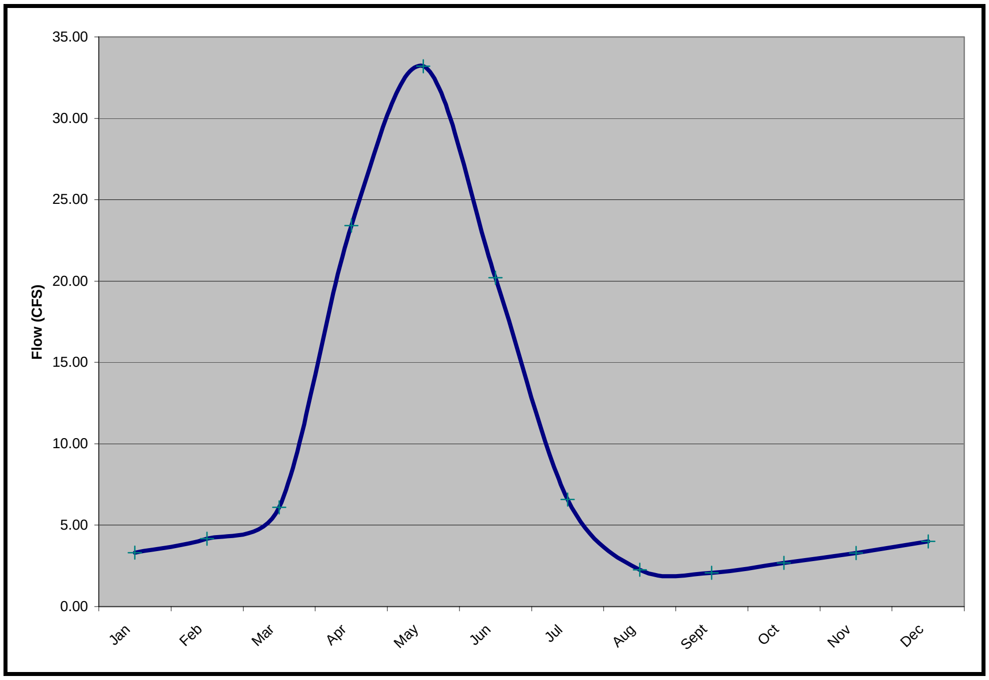

Figure 44. Round Valley Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

Rainbow trout, cutthroat trout, and brook trout are found in Round Valley Creek. Chinook salmon and steelhead are not observed within Round Valley Creek due to the falls on the Little Salmon River, a natural fish passage barrier. Bull trout have not been observed within Round Valley Creek.

Habitat

A 2000 PfanKuch Channel Stability Evaluation found the mainstem on forest service lands to be in good condition in the upper section and fair condition closer to the forest boundary. DEQ water body assessment scores have shown that beneficial uses are not impacted (Table 20).

Table 20. Round Valley Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
1994SBOIA017	3	3	Not Measured	3	Full Support
1994SBOIA018 (North Branch)	2	3	Not Measured	2.5	Full Support

Conclusions

Beneficial uses are not impaired and a TMDL is not necessary for Round Valley Creek.

Hazard Creek

Hazard Creek (Figure 45 and Figure 46) originates at 8,767 feet, flows west and enters the Little Salmon River about 19.1 miles above the mouth of the river. Hazard Creek is a fifth order stream that drains an 86 mile2 area and provides important salmonid habitat.

The *headwaters* of Hazard Creek are bordered by Bruin Mountain (elevation 8,766 feet) on the east, Hard Butte (elevation 8,658 feet) on the north, and the Grass Mountains on the south, which separate the Hazard Creek drainage from the Hard Creek drainage. Hazard Creek is in assessment units 17060210SL014_02 and 17060210SL014_03, and its tributary, Hard Creek is in assessment units 17060210SL015_02 and 17060210SL015_03.

Hard Creek (**Figure** 47) is a fourth order stream and enters Hazard Creek at stream mile 0.9. The drainage area of Hard Creek (24,053 acres) is slightly smaller than Hazard Creek (27,865 acres). The Hard Creek drainage is bordered by the Grass Mountains on the north, Granite Mountain (elevation 8,478 feet) on the south, Bally Mountain (elevation 6,818 feet) on the west, and an unnamed mountain (elevation 8,255 feet) on the east. Hard Creek flows west and north until it enters Hazard Creek.

The headwaters area of the Hazard Creek watershed burned in 1989, 1992, and 1994. Salvage logging took place in 1996, 1997, and 1998.

Figure 45. Hazard Creek (August 2003).

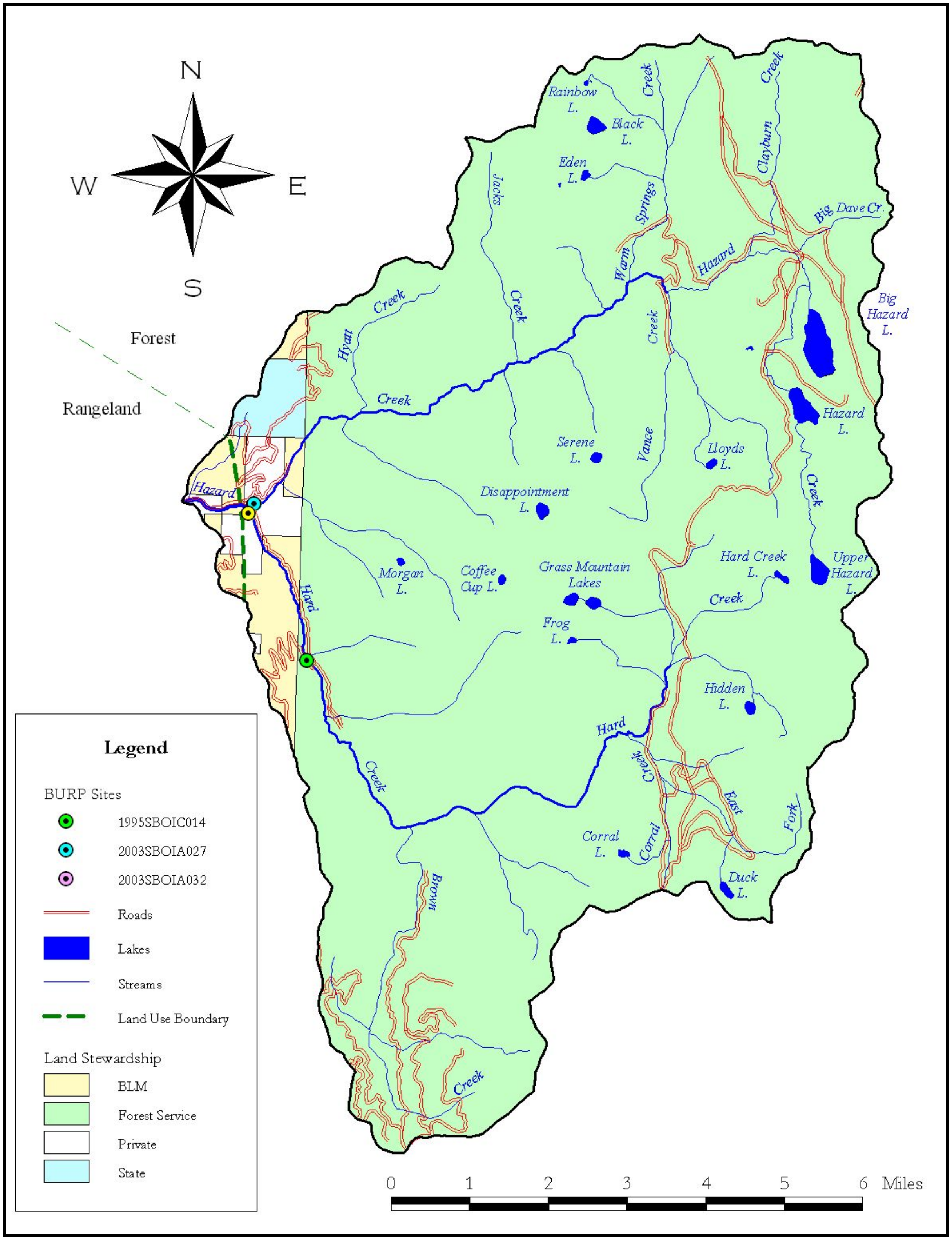

Figure 46. Hazard Creek and Hard Creek Watershed.

Figure 47. Hard Creek, a Tributary of Hazard Creek (August 2003).

Geology

The dominant geologic type is the border/transition type of the Idaho Batholith. This geologic type consists of granitic rocks, granitic gneisses, schist, quartzites, and other metamorphic rocks. Glacial activity has shaped the Hazard Creek basin.

An erosion inventory of the Forest Service managed lands showed that 35.6% of that area was erosion sensitive. This percentage is partly attributable to the granitic soils of the Idaho Batholith in which the watershed lies. These decomposed granitics are more susceptible to disturbance (i.e. fires, road construction, timber harvest, grazing) than watersheds within the subbasin that are in predominantly metamorphic or volcanic rock.

Vegetation

Common riparian species include subalpine fir, Engelmann spruce, grand fir, cottonwood, and birch; a midstory of alder, prickly currant, dogwood, serviceberry, and willow; and an understory of sweet-scented bedstraw, bead lily, starry solomon-plume, twisted stalk, lady fern, arrowleaf groundsel, monkshood, meadow rue, and miner's lettuce depending on elevation, aspect, and canopy cover. Due to flood stage discharges, there is little streamside soil or vegetation below the high water mark. Riparian vegetation is brush mixed with occasional conifers (Horton 1983). High coverage of mosses and liverworts occur on rocks and stream banks.

Upland vegetation types are diverse and represent a range of seral stages, which are primarily influenced by past timber harvest, fires, and livestock grazing. Lower elevations are dominated by a mixed conifer overstory, which includes Douglas fir, grand fir, larch, and ponderosa pine. Upper elevations are dominated by grand fir, Douglas fir, larch, Engelmann spruce, lodgepole pine, and subalpine fir. The timber is interspersed with patches of perennial grassland, brush, and riparian vegetation (USFS 1994a).

Land Use

The Hazard Creek watershed covers 43 square miles. About 96% of the basin is public land. Federal agencies manage about 26,515 acres. State and local governments manage 471 acres. Private ownership, 459 acres, is clustered primarily along the downstream end of the basin. The Hard Creek watershed covers 38 square miles. The majority of the basin is public land with some private land in the lowest reaches.

Hazard Creek headwaters are primarily undeveloped except for a road and recreational use associated with it. One developed and one dispersed campground, and several trails exist in the watershed. The watershed receives moderate recreational use from hiking, horseback riding, and off-road vehicles. Hunting activity is heavy in the late fall.

The headwaters are managed for sheep grazing. The lower reaches are irrigated agricultural land and grazing. Two grazing allotments are permitted on BLM lands within the Hazard-Hard Creeks drainage. The Hard Creek allotment permits 218 AUMs of sheep and the Little Elk Creek allotment permits 103 AUMs of cattle. Various USFS grazing allotments occur within the Hazard/Hard Creek watershed. Grassy Mountain S&G, Vance Creek S&G, Jacks Creek C&H, and Hersey Lava S&G are within the Hazard Creek watershed. Meadows Valley C&H, Brown Creek C&H, and Grassy Mountain S&G are within the Hard Creek watershed. In 2004, the Grassy Mountain permit allowed 930 ewe/lamb pairs to graze between July10 and September 21. The Vance Creek permit allowed 1700 dry ewe to graze between September 22 and October 15. The Jacks Creek permit allowed 420 cow/calf pairs to graze between July 11 and October 10. The Hersey Lava permit allowed 930 ewe/lamb pairs to graze between July 10 and September 21. The Meadows Valley permit allowed 445 cow/calf pairs to graze between June 1 and September 30. The Brown Creek permit allowed 235 cow/calf pair to graze between August 7 and September 30.

Recent timber activity consists of the Forest Service Hazard Lake Salvage Sale. Logging has taken place on both federal and non-federal lands. A mine claim was previously in use within the middle section of Hazard Creek but closed in 1984.

Road densities within the drainage are separated into lower and upper sections for both Hazard Creek and Hard Creek. Upper Hazard Creek has a road density of 0.90 mi road/sq. mile, 24% within Riparian conservation areas (*RCA*). Lower Hazard Creek has a road density of 0.81 mi road/mile^2, 21% within RCA. The Forest Service characterized the road density in this drainage as moderate at 0.71 mi road/ square mile. Upper Hard Creek has a road density of 1.03 mi road/mile^2, 38% within RCA. Lower Hard Creek has a road density of 1.8 mi road/mile^2, 19% within RCA.

Hydrology

Hazard Creek is predominately a Rosgen Stream Type (RST) A2/B3. Riffles, pools, and braids with stable boulder/rubble substrate flow through deeply entrenched channels. The lower and upper elevations are RST A2a, flowing through pools and falls with deeply entrenched large boulder channels (USFS 1994a). The Delbaere-Campbell ditch diverts water from Browns Creek (a Hard Creek tributary) to Six Mile Creek.

A 1983 in-stream flow investigation by the BLM developed the following recommendations for Hazard Creek from Hard Creek to Jacks Creek: 18 cfs from August 1 to March 15 for trout passage, 32 cfs from March 16 to March 31 for trout passage, 38 cfs from April 1 to June 30 for steelhead trout spawning, and 32 cfs during July for Chinook salmon passage (Howard 1983).

The hydrograph of Hazard Creek exhibits typical flow regimes for west-central lower elevation Idaho mountain streams (Figure 48). The peak flow is observed May to June, and base flow is observed by August.

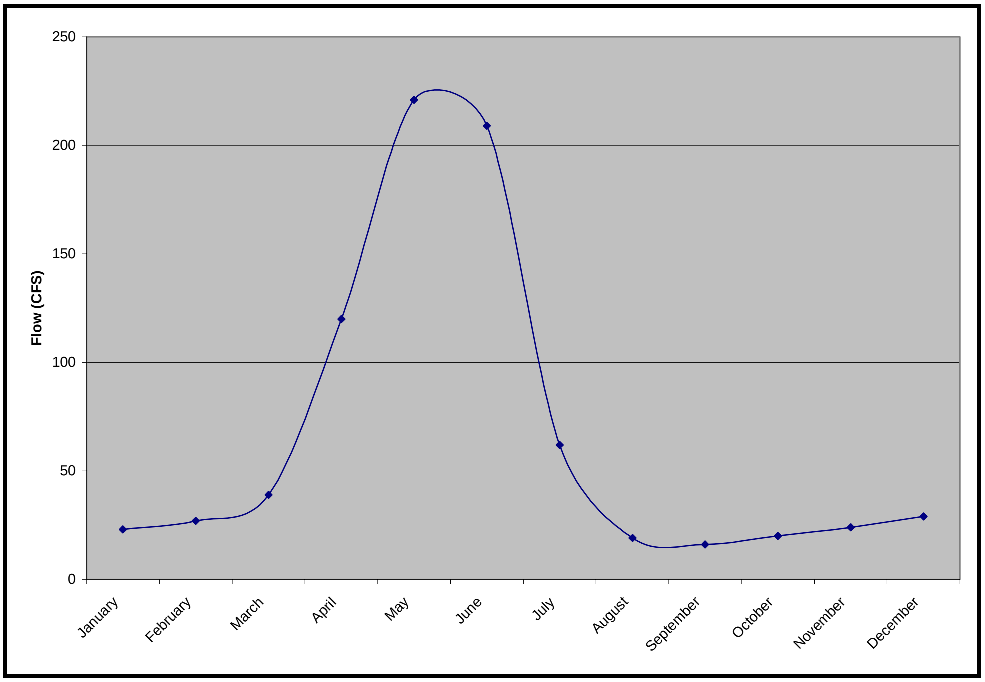

Figure 48. Hazard Creek: Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

Chinook salmon, steelhead, fluvial bull trout, and cutthroat trout are able to access the cold water habitat. A full passage barrier (falls) for spring/summer Chinook salmon, steelhead trout, and bull trout occurs at stream mile 3.7 on Hazard Creek. A partial/full barrier (whether it is a partial or full barrier is dependent upon flow) restricts Chinook salmon and bull trout fish passage at stream mile 0.6 on Hard Creek (steelhead trout are still able to get by). A full passage barrier for steelhead trout occurs at stream mile 4.7 on Hard Creek.

Hazard Creek, from mouth to falls, supports primarily steelhead, secondarily Westslope cutthroat trout and bull trout spawning and rearing. Limited spawning and rearing habitat for Chinook salmon, steelhead trout, and rainbow trout exists mostly near the mouth. Upstream, from the falls to the headwaters, is dominated by brook trout with some redband/rainbow trout (IDWR 2005). Hard Creek provides habitat for Westslope cutthroat trout, steelhead, Chinook salmon, bull trout, rainbow trout, and brook trout.

The Hard/Hazard Creek complex is considered of medium importance for bull trout. The lower reaches of Hazard and Hard Creeks are used by *fluvial* bull trout for subadult and adult rearing. Upstream of the barriers on Hard Creek, additional suitable habitat exists for bull trout. The entire Hazard Creek watershed is considered a key bull trout watershed because of important production of forage fish (Batt 1996). BLM and IDFG monitoring efforts have documented the presence of bull trout in the lower reaches of the watersheds but numbers are low.

Downstream of the barriers, in both Hazard and Hard Creeks, sculpin and suckers have been observed.

Habitat

The substrate of Hazard Creek is characterized by large boulders and cobbles. Gravel substrate, suitable for trout and salmon spawning, is present in pocket pools behind large boulders. The tributaries to Hazard Creek are high gradient channels with boulder and cobble substrate. Some headwater tributaries contain sand/silt within the streambed.

Hazard Creek and Hard Creek both originate within plutonic parent material. According to Overton (1995), plutonic Rosgen Stream Type (RST) A and B *reference condition* streams have mean percent surface fines of 26 and 23% respectively. DEQ compared USFS percent fines scores with Overton mean scores to determine if habitat impairment was evident. A 1993 Forest Service survey of Hazard Creek recorded percent surface fines between 4.7 and 67%. Two reaches within the headwaters of Hazard Creek were well above the Overton mean for RST A and B. Within a RST A section, 48% surface fines were observed, and a RST B section had 67% surface fines. One section of RST C had 27.5% surface fines, which is below the Overton mean of 37% for RST C plutonic streams. Substrate monitoring of Hazard Creek is performed annually further downstream within RST B. Results show mean percent surface fines between 0.6 and 4.3%.

In 2005, DEQ personnel investigated bank stability in the headwaters area and performed general reconnaissance to see what factors may have contributed to elevated fines. The riparian area throughout the headwaters area appeared healthy although in the meadows areas, large shrubs were not present in great numbers. Salvage logging had occurred throughout the drainage but the slopes had revegetated and the riparian areas were intact. All streambanks surveyed, which included Rosgen A, B and C channels, showed greater than 90% stability. The elevated percent fines observations, which occurred just after the 1992 fire, may be attributable to sediment delivery after the fire.

A 1993 Forest Service study of Hard Creek recorded percent surface fines of 0.3 to 11.5% Substrate monitoring of Hard Creek within RST B show mean percent fines of 2.1 to 8.3% over the past 10 years. These numbers are well below the Overton mean percent surface fines for plutonic streams.

PfanKuch Channel Stability Evaluations done in 1993 and 2004 found sections along the mainstem of Hazard Creek on forest service lands to be in good condition.

The watershed had an ECA (equivalent clearcut area) rating of 21% which is below the 30% threshold of hydrologic impact risk. ECA is an indicator of basin condition that is calculated from the total amount of crown removal that has occurred from harvesting, road building, wildfire, and other activities, based on the current state of vegetative recovery**.**

Table 21 shows that beneficial uses are not impaired in the Hazard and Hard Creek watersheds. (Figure 46 shows the DEQ monitoring locations, which are in the lower reaches of the watershed.)

Table 21. Hazard Creek and Hard Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
2003SBOIA027 (Hazard Creek)	3	3	3	3	Full Support
2003SBOIA032 (Hard Creek)	3	2	1	2	Full Support

Temperature

Hazard Creek is an important tributary to the Little Salmon River with regard to water quality. It contributes cold water to temperature-limited salmonids in the Little Salmon River during the summer (IWRB 2001). The Hazard-Hard Creek complex provides a sustained contribution of cold water that supports downstream salmonid habitat (IWRB 2001). These creeks meet the state water quality criteria for temperature (Figure 49 and Figure 50).

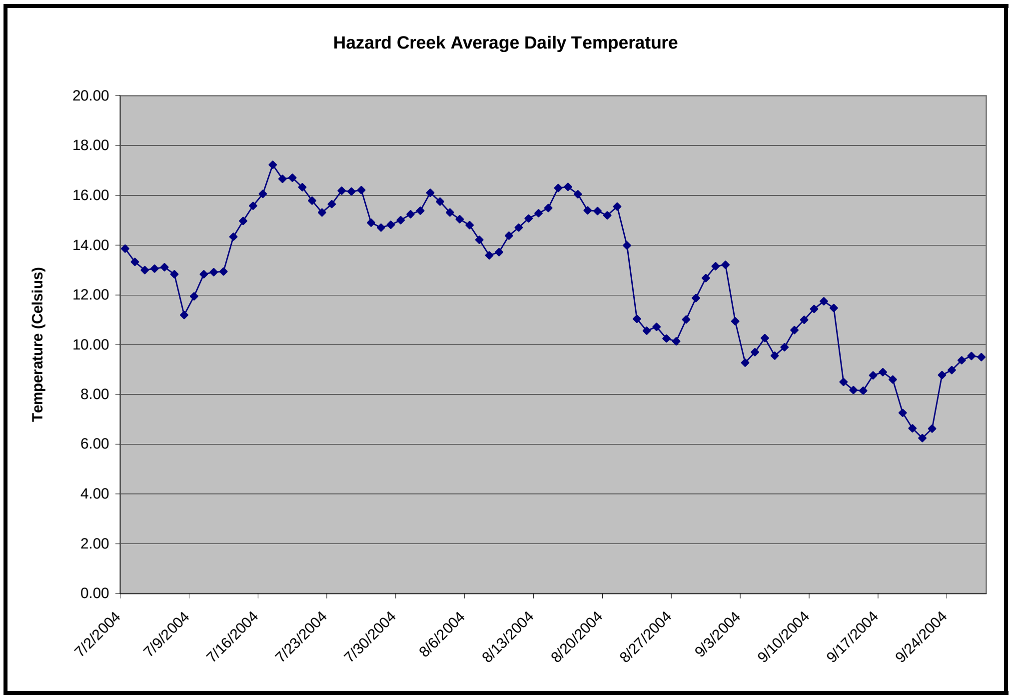

Figure 49. Hazard Creek Summer Average Daily In-stream Temperatures (USFS 2004).

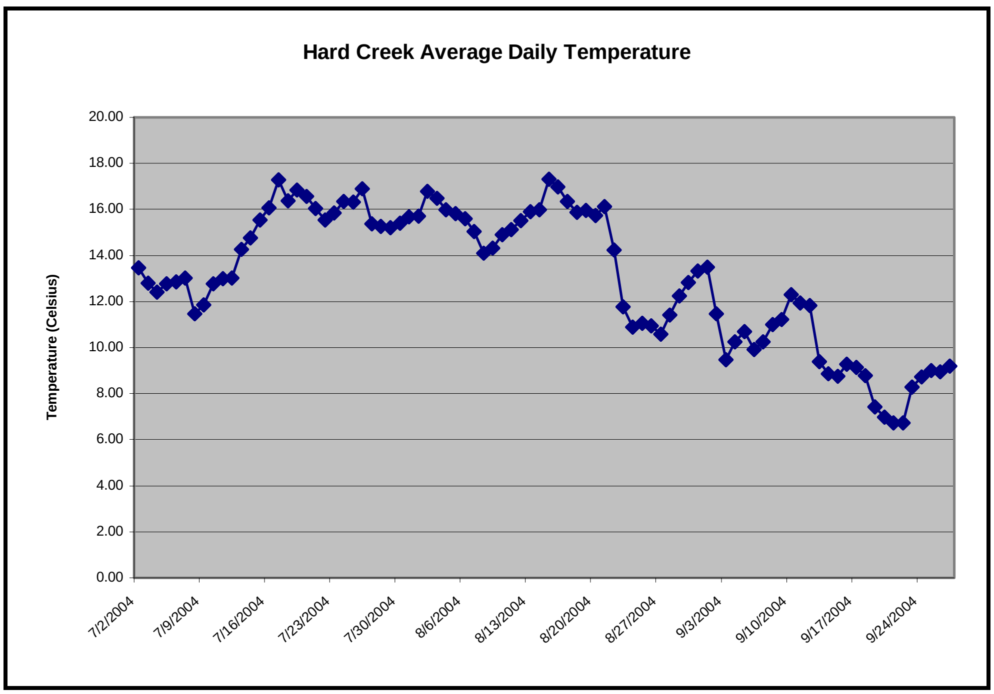

Figure 50. Hard Creek Summer Average Daily In-stream Temperatures (USFS 2004).

Conclusion

Hazard Creek is an important cold water contributor to the Little Salmon River and provides cold water fisheries habitat. The beneficial uses in the Hazard Creek watershed are not impaired. A TMDL is not necessary.

Boulder Creek

Boulder Creek (Figure 51) is a fourth order drainage, which flows into the Little Salmon River at river mile 17.7. The Boulder Creek watershed (Figure 52) has a total of 25,175 acres (41 square miles). It originates at an elevation of 6,900 feet and flows north-easterly into the Little Salmon River at an elevation of 3,040 feet. The highest point in the drainage is Pollock Mountain at 8,048 feet. The north and west side of the drainage is bordered by Pollock Mountain, North Star Butte (7,451 feet), and Ant Butte (7,047 feet). The southern and eastern side is bordered by Brush Mountain (6,247 feet). Boulder Creek is in assessment units 17060210SL005_02 and _03.

A natural falls in Boulder Creek (stream mile 4.4) was modified in 1985 to allow fish passage into the upper watershed. An investigation of the falls was made in 1983, and at this time several large bull trout were observed immediately below the falls in a large deep pool. The bull trout were observed trying to jump over the falls and were jumping four feet in height but could not negotiate the falls. The barrier at this time consisted of a bedrock "beaver-slide" falls that was 7 feet high and 10 feet in length. The pool below the falls was estimated at 6 feet deep. In 1985, the Idaho Department of Fish and Game modified the falls through the bedrock excavation of immediate jumping pools (DEQ 1998). Now all fluvial bull trout and Chinook salmon, have access to the upper watershed.

Figure 51. Boulder Creek Falls (August 2002).

Geology

Surface geology of the watershed is a mix of granitics, transitional zones of metamorphosed granitic rocks, volcanics, and basalts. A fault line is present along middle Boulder Creek, and the upper reaches are highly faulted.

The lower reach is in an active landslide zone, which has caused accelerated sediment loading. Past and recent landslides contributed significant amounts of sediment to Boulder Creek and the Little Salmon River. In March 1989, a debris torrent occurred in Hillman Creek, a tributary of Boulder Creek at stream mile 1.7, resulting in significant amounts of sediment reaching Boulder Creek. The Hillman Creek drainage and other tributary drainages in Boulder Creek also experienced significant debris torrents during the January 1, 1997 storm event (IDEQ 1998).

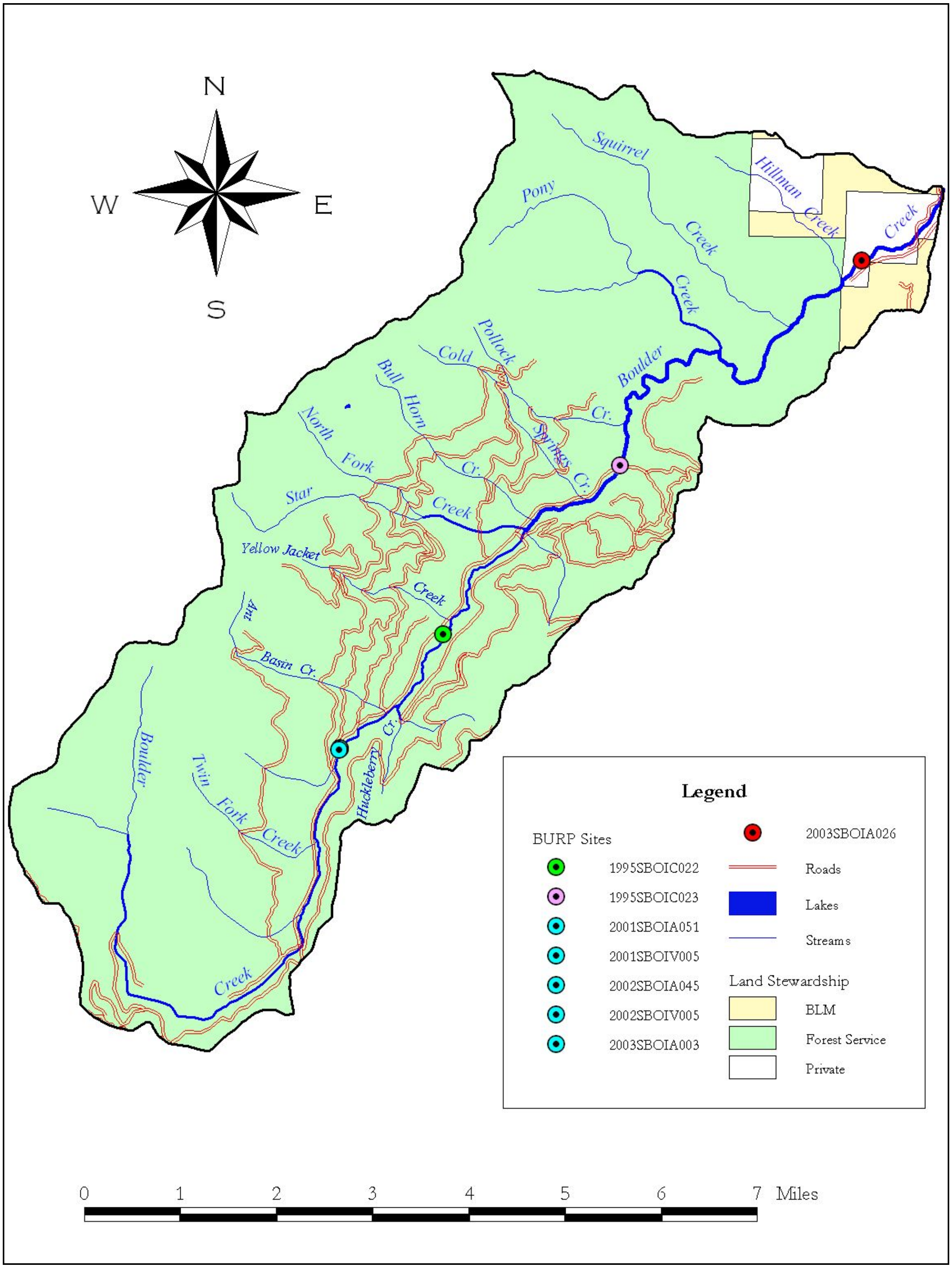

Figure 52. Boulder Creek Watershed.

Vegetation

Common riparian species include subalpine fir, Engelmann spruce, grand fir, alder, currant, red-osier dogwood, syringa, willow, gooseberry, sweet-scented bedstraw, bead lily, starry solomon-plume, twisted stalk, lady fern, monkshood, meadow rue, miner's lettuce, sedges and forbs depending on elevation, aspect, and canopy cover. High coverage of mosses and liverworts occur on rocks and stream banks.

Upland vegetation types are diverse and represent a range of seral stages, which are primarily influenced by past timber harvest, fires, and livestock grazing. Lower elevations are dominated by a mixed conifer overstory, which includes Douglas fir, grand fir, larch, and ponderosa pine. Upper elevations are dominated by grand fir, Douglas fir, larch, Engelmann spruce, lodgepole pine, and subalpine fir. The timber is interspersed with patches of perennial grassland, brush, and riparian vegetation.

Land Use

The lowermost portion of the watershed is primarily private land (3% of the total watershed) and BLM managed public land (3% of the total watershed), and the upper portion of the watershed is Forest Service managed public land (94% of the total watershed) (Figure 53).

Boulder Creek headwaters are undeveloped and in National Forest Service land. The rest of the creek has been impacted by stream alterations including removal of large wood from the floodplain and hardening of the stream banks. These alterations are believed to have contributed to decreased production of Chinook salmon, steelhead, bull trout and Westslope cutthroat trout (IDWR 2001).

Logging has occurred on the southern slopes of the Boulder Creek drainage, particularly within the middle area of the watershed.

Figure 53. Middle of Boulder Creek Watershed (August 2004).

An extensive road network is found throughout the upper and lower watershed. This road network has reduced habitat connectivity at some locations by eliminating fish passage (USFS 2003). Lower Boulder Creek has a road density of 2.75 mi road/square mile, 30% of which are in Riparian conservation areas (RCA). The lower end of Boulder Creek has been subdivided. Upper Boulder Creek has a road density of 4.15 mi road/square mile with 29% within RCA.

Grazing is currently permitted on four Forest Service allotments and two BLM allotments in the watershed. The Forest Service allotments include: Boulder Creek S&G; Round Valley C&H; Fall Creek/Whitebird C&H; and Price Valley S&G. In 2004, the Boulder Creek permit allowed two bands of 950 ewe/lamb pairs to graze between July 11 and August 21. The Round Valley permit allowed 110 cow/calf pairs to graze between June 15 and August 1. The Fall Creek/Whitebird permit allowed 240 cow/calf pairs to graze between June 10 and October 31. The Price Valley permit allowed two bands of 950 ewe/lamb pairs to graze between June 16 and July 10. The BLM Hard Creek allotment and the Trail Creek allotment permits 218 AUMs of sheep and 85 AUMs of cattle, respectively, to graze on BLM lands within the Boulder Creek area.

Numerous trails occur in the watershed for recreational use as well as livestock movement between pastures and allotments. Camping, hunting, fishing, hiking, and ATV are the major recreational uses within the drainage.

Hydrology

Boulder Creek consists of a number of second-third order tributaries. The stream is comprised primarily of Rosgen Stream Type (RST) B channels (79.8%). The lower stream section from the confluence with the Little Salmon River upstream for about two miles is predominately RST A channel (12.4%). A short section of RST C channel is found near Yellow Jacket Creek (7.8%).

The Boulder Creek hydrologic regime is typical of central Idaho mid-elevation streams. The peak run-off occurs in April/ May and base flows are reached by late July (Figure 54). Table 22 shows the estimated irrigation use. There are water rights both on the public and private lands.

Table 22. Boulder Creek estimated irrigation use.

	Estimated Existing Use (155 acres irrigation) (cfs)
January	1.9
February	1.9
March	1.9
April	5.6
May	9.2
June	9.2
July	9.2
August	8.6
September	5.7
October	2.0
November	1.9
December	1.9

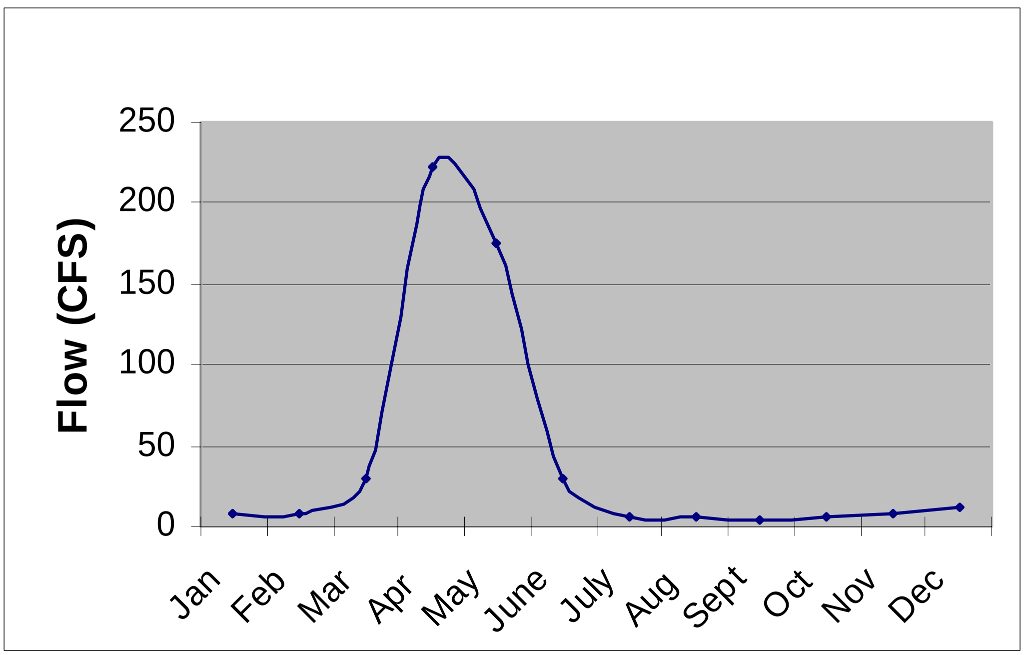

Figure 54. Boulder Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

Game fish species found in Boulder Creek include rainbow trout, steelhead trout, and Chinook salmon. Brook trout, bull trout, Northern pike minnow, and sculpin have also been observed within Boulder Creek (BLM 2000).

Boulder Creek is second to the Rapid River in providing good salmonid habitat in the Little Salmon River drainage (U.S. Department of Interior 1993, 1994). It is important habitat for Chinook, steelhead, bull trout, and cutthroat trout. Boulder Creek is considered of high importance for bull trout spawning and early rearing (IDEQ 1998). Road crossings (culverts) have reduced connectivity between Boulder Creek and tributary subpopulations (USFS 2003).

Lower Boulder Creek provides spawning and rearing habitat for spring/summer Chinook salmon and steelhead trout. Spawning and rearing habitats for spring/summer Chinook salmon are found on the lower four miles (Mallet 1974). Periodicity information is shown in Table 4 in Section 1.2. In late spring, 1997, the middle RST C-channel section of Boulder Creek above the falls was surveyed for spawning steelhead but no fish were observed. In 1997, a large number of adult Chinook returned to the Rapid River Fish hatchery. Excess adult fish were transported upstream near Boulder Creek. Later that year in August, spawning ground surveys found these hatchery salmon distributed upstream along Boulder Creek to the above-mentioned falls. No adults were found upstream of the falls. During snorkel surveys, IDFG & USFS personnel have found juvenile Chinook above the falls (Olson, personal communication). Annual spawning surveys conducted by the USFS since 2002 have found adult Chinook salmon within Boulder Creek downstream of the falls.

During a 1991 Forest Service Intermountain Station fish inventory, all reaches of Boulder Creek were extensively snorkeled. This inventory found 69% of all bull trout in the middle of the stream near Yellow Jacket Creek (approximate stream mile 10). The largest number of brook trout (65%) were also found in the same section. Larger sized fish (greater than 300 mm) were conspicuously absent from Boulder Creek. Yellowjacket Creek was surveyed by the USFS in 2002. The surveyors reported a narrow channel, the presence of brook trout, and dense riparian canopy. Field notes suggest that the reach was difficult to snorkel survey and more fish may have been present.

A 2002 IDFG report stated that redband and brook trout were abundant in the upper reaches of Boulder Creek (IDFG 2004).

Habitat Data

Boulders and cobble size rocks are the primary substrate within the lower reaches. Deep pools and fast moving sections are both present. Gravel is found in pockets behind boulders but adequate sized spawning gravel for trout is limited. However, salmon are apparently able to spawn successfully in the larger substrate (Horton 1983). The upper reaches of Boulder Creek consist of cobble and gravel substrate with some sections of large cobble or boulder.

Figure 55. Lower Boulder Creek.

Boulder Creek originates within volcanic and plutonic parent material types. According to Overton (1995), plutonic RST A, B, and C have mean percent surface fines of 26, 23%, and 37% respectively, while volcanic RST A, B, and C have mean percent surface fines of 25, 27%, and 17% respectively. Substrate monitoring on Boulder Creek within a RST B show mean percent surface fines of 1.9 to 14.3% over the past 10 years. These values are below the Overton values for volcanic and plutonic RST B, meaning that the conditions in Boulder Creek are similar to those found in pristine streams.

Large woody debris and width-depth ratios were determined to be at levels that were functioning appropriately (USFS 2003). Large pools are present in lower Boulder Creek but overall, pool frequency appears to be low. Pools provide feeding and resting habitat for fish.

A 1992 PfanKuch Channel Stability Evaluation found sections of fair and good conditions on the mainstem streambanks on forest service lands.

DEQ data for Boulder Creek shows that beneficial uses are not impaired (Table 23). Monitoring locations are shown in Figure 52. Monitoring sites occurred both in the upper and lower reaches on public and private land.

Table 23. Boulder Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
2003SBOIA003	3	3	Not Measured	3	Full Support
2002SBOIA045	3	3	2	2.67	Full Support
2002SBOIV005	3	3	2	2.67	Full Support
2001SBOIA051	3	3	3	3	Full Support
2001SBOIV005	3	3	Not Measured	3	Full Support
1995SBOIC022	3	3	Not Measured	3	Full Support

Conclusions

Boulder Creek is an important fishery. While human caused impacts occur within the watershed, overall, the beneficial uses in the Boulder Creek watershed are not impaired as shown by recent and past DEQ data in both the upper and lower reaches of Boulder Creek. A TMDL is not necessary.

Elk Creek

Located near the town of Pinehurst, Elk Creek (Figure 56) is a third order stream that enters the Little Salmon River at approximately river mile 16.6. The Elk Creek watershed covers 14.8 miles^2 (9,489 acres) and is oriented in a southwesterly direction with side tributaries entering mostly from the east. Elevation in the watershed ranges from 2,940 feet where Elk Creek empties into the Little Salmon River to 7,994 feet in the headwaters (IDL 2002b). Hard Butte (elevation 8,658 feet) is located on the south eastern edge of the watershed. Elk Creek flows through a moderate to steep sloped canyon, passing through both forested and open grassland areas.

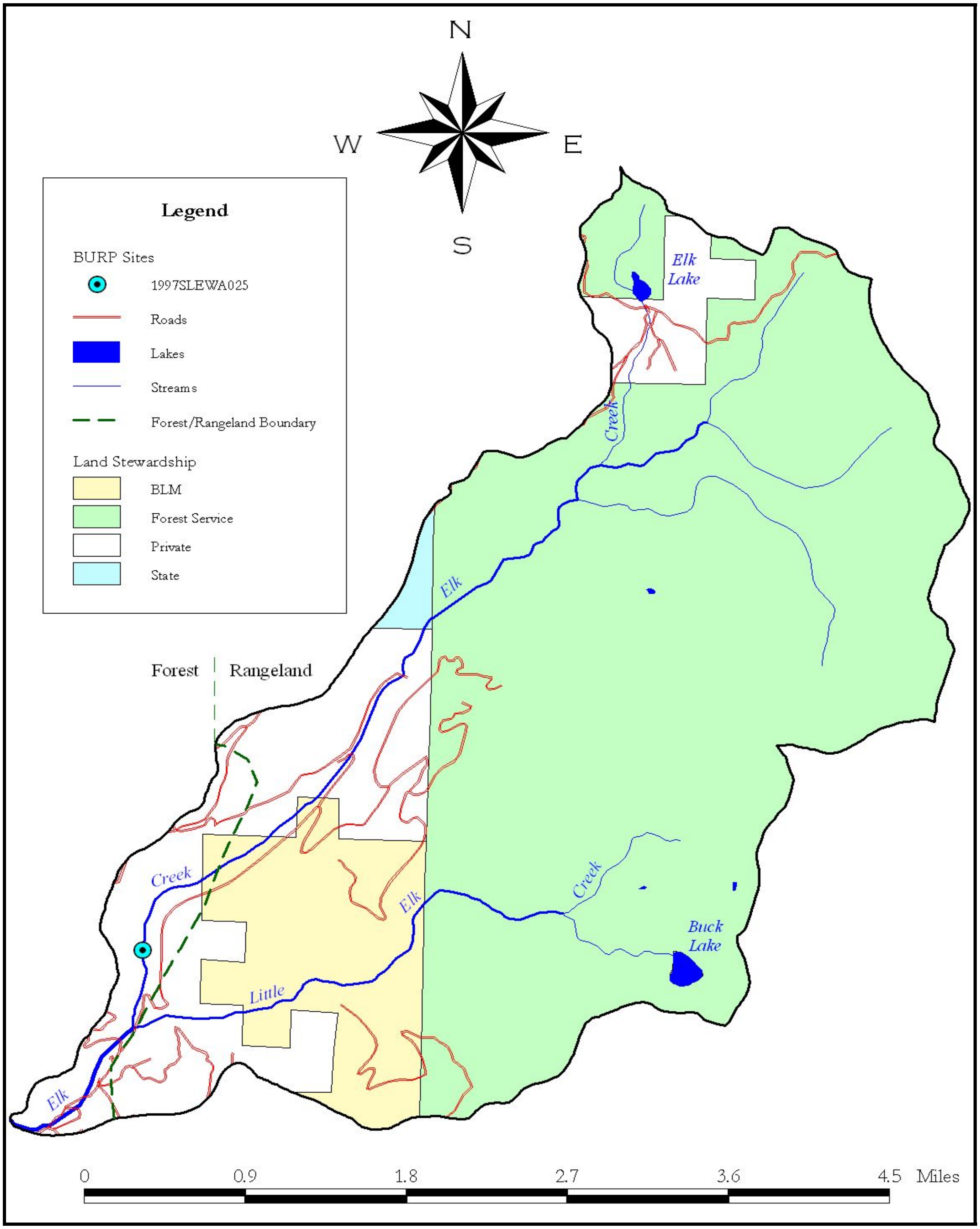

Figure 56. Elk Creek Subwatershed.

A small hydroelectric project occurs within the drainage. The diversion dam occurs at stream mile 3.7, which diverts water through a buried penstock to a power house located approximately 150 feet from the mouth of the stream. A fish ladder has not been constructed for this project.

Comparison between 1994 and 2003 aerial photographs shows an increase in structures between the mouth of Elk Creek up to Little Elk Creek. No new roads appear to be developed and old timber roads have either been obliterated or revegetated. No new timber harvest is apparent. Within the upper area of Elk Creek, near Elk Lake, some new trails appear to have been made by ATVs, but these trails are concentrated away from the creek and do not appear to be a major source of sediment.

Geology

The Elk Creek drainage is predominately underlain by highly and weakly weathered granitics of the Idaho Batholith and is bisected by large basalt flows. These granite rocks are typically divided with the highly weathered material occurring along the lower elevations and dominating the main stem flood plain and lower tributary flood plains. The upper Elk Creek basin has been scoured by glaciers and much of the lower drainage is underlain by the glacial drift/till. The weakly weathered granitics and basalt ridges and escarpments are common in the uplands and ridgelines

Vegetation

Vegetation varies with elevation and aspect. Strong south to east facing slopes at lower elevations support ponderosa pine, with spruce present in the riparian zone. A midstory of alder and an understory of forbs and grasses exist in the lower elevations. On northwest facing slopes and with increasing elevation, forest stands become denser with Douglas fir, grand fir, western larch, spruce, lodgepole pine, and ponderosa pine overstory. Alder, willow, spirea and currants grow densely within the midstory of the riparian areas. Ferns, grasses and forbs cover the understory. The headwaters are characterized by forbs and carex species with sparse subalpine fir and lodgepole groves (USFS 1993a).

Land Use

About 80% of the basin is public land. Federal agencies manage 7,522 acres. State and local governments manage 68 acres. Private ownership, 1,884 acres, is clustered primarily along the downstream end of the basin. Elk Creek headwaters are undeveloped and lie in the Payette National Forest. The upper reaches are managed for timber production and grazing. The lower reaches are irrigated agricultural land, grazing and subdivisions. Access to lower Elk Creek is difficult due to the amount of private land along it.

Logging has occurred within the Elk Creek drainage on both private and public lands. Most of the logging on the public land has occurred between the Elk and Little Elk Creek watersheds. Apparently, no logging has occurred near the riparian zone. However, in the upland portions of a tributary to Elk Creek, significant logging had occurred. Clearcuts on extremely steep land have been observed, often without protective buffer strips along the streams. The impact of this logging on sediment input to the stream is difficult to ascertain (USFS 1994b).

Very light livestock use occurs on the BLM managed land in the upper watershed. The Little Elk Creek allotment on BLM lands allow 103 AUMs of cattle to graze within Elk Creek and Little Elk Creek drainages. Grazing within the riparian area is very light. Primary grazing use is associated with timber harvest units and roads. Grazing along intermittent or perennial streams is generally light and no measurable adverse sediment or temperature impacts are predicted to occur to downstream listed species habitat (i.e., Little Salmon River, mouth area of Elk Creek, and Hazard Creek) (BLM 2000). The USFS Elk Lake S&G grazing allotment has been rested for the past few years. Use has been limited to driving stock through the allotment to reach the USFS Jacks Creek allotment. The Jacks Creek Allotment permits 420 head of cattle to graze from mid-July to mid-October. Grazing impacts to the stream are limited to areas where the cattle congregate and drink water. This activity affects the riparian community and causes increased sedimentation to the stream (USFS 1994b).

Limited road access is accessible by ATV or four-wheel drive only. Most of these trails are on private land and outside of the streams riparian zone. The potential impacts from these roads are assumed to be negligible (USFS 1994b). Road density within the Elk Creek drainage is at 1.87 road miles/mile^2; 18% of these roads are within RCAs.

IDWR (2004) estimated 320 acres in the drainage were irrigated.

Hydrology

Elk Creek is a 3rd order tributary, with a dendritic stream feeder pattern, to the Little Salmon River. The Elk Creek stream channel alternates between Rosgen Stream Type (RST) A, B and C, although it is primarily a RST A (A3 and A3+). The upper reaches on Forest Service land are primarily RST B with some RST A and C.

The area has an average annual precipitation ranging from 15 inches at the lower elevations to 40 inches at the higher elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events (IDL 2002b). Flow data for Elk Creek was estimated by the Idaho Department of Water Resources (Figure 57). Table 24 shows the estimated irrigation use in the watershed.

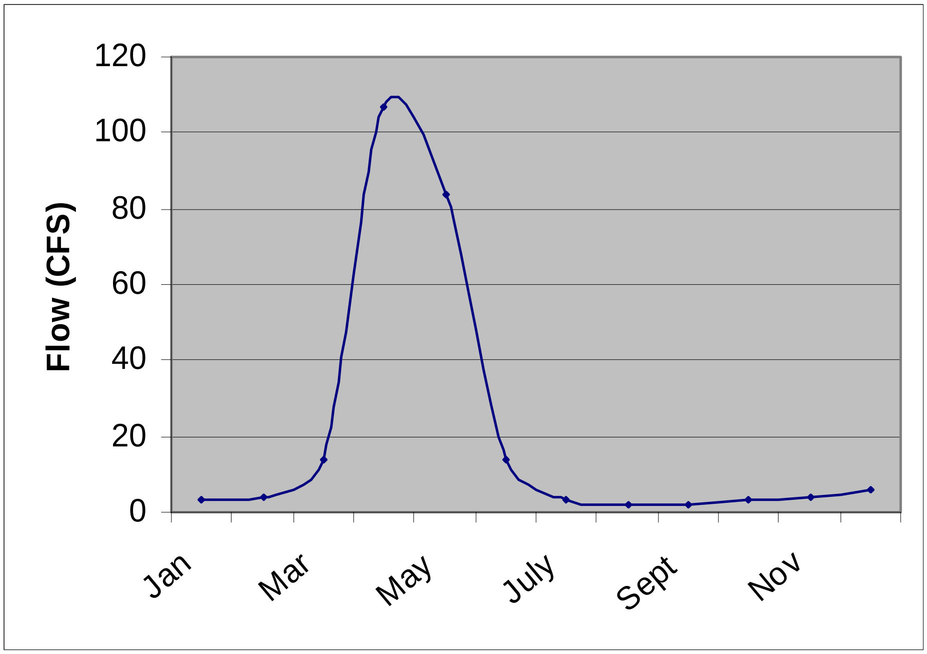

Figure 57. Elk Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Table 24. Elk Creek estimated irrigation use.

	Estimated Existing Use (321 acres irrigation) (cfs)
January	0
February	0
March	1
April	12
May	12
June	13
July	6
August	3
September	0
October	0
November	0
December	0

Temperature

Stream temperatures within Elk Creek and Little Elk Creek are within the range of temperatures considered optimal for all life stages of resident trout (USFS 1994b). The primary limiting factors for fish production in Elk Creek include steep gradient and lack of good quality pools (BLM 2000).

Fisheries

A 12 foot bedrock falls creates a fish barrier 0.1 miles from the mouth of the stream. Adult steelhead are documented in Elk Creek from the mouth to the barrier falls at river mile 0.1.

Upstream of the falls, brook trout and rainbow trout have been observed (BLM 2000). This mouth area of the stream provides very limited Chinook salmon rearing habitat (IWRB 2001). Rainbow trout have been documented in Little Elk Creek but the high gradient of the stream may limit fish populations (USFS 1994b). No bull trout use has been documented for this stream.

Habitat Data

A CWE analysis of Elk Creek (IDL 2002) showed low sediment delivery to the stream from roads. The USFS reported that sediment input from roads in the upper watershed is low (USFS 1994b). Although surface erosion hazard was estimated to be high, the actual amount of sediment being transported into the stream appears to be minimal. These ratings refer to potential for sedimentation and on the ground measurements show that excess stream sedimentation is not occurring. Surface erosion hazard ratings are based on surface soil where the above ground vegetation and duff have been removed but the soil itself has not been substantially disturbed. Mass Failure hazard rated as moderate. Channel stability was rated as moderate. Overall sediment delivery rating which combines road, skid trail and mass failure estimates was low (IDL 2002). A 1994 USFS watershed analysis identified a 1992 fire as the major source of sediment to the stream at that time.

Stream substrate correlated to channel type. RST A and B typically were characterized by cobble, boulder and bedrock where as RST C were dominated by fines, gravels and small cobbles. Percent surface fines in the RST C averaged 31% which is below the 37% reference condition found in RST C pristine streams originating in plutonic parent material. The stream banks within Elk Creek are highly stable (99% of total length). A 1993 Pfankuch Channel Stability Evaluation found fair and good conditions on the mainstem on forest service lands. Erosion of the stream banks does not appear to contribute significantly to the sediment load of the stream (USFS 1994b).

On March 11, 2005, DEQ employees surveyed Elk Creek. The location of the survey was below the confluence of Elk Creek and Little Elk Creek. Three transects were measured and the averages were compared to the Overton (1995) descriptions of fish habitat within natural conditions of the Salmon River Basin. The width to depth ratio of a metamorphic stream type should be 26 (Overton, 1995). The survey recorded width to depth ratio for Elk Creek as 32. Percent surface fines of a metamorphic stream should be 14% (Overton 1995). The 2005 survey recorded percent fines at 4.3% within the wetted width and 10.8% within the bankfull width of Elk Creek. Bank stability within the survey area was 100%. The substrate along the banks was predominately boulders with pebble and cobble filling in the gaps and areas of slower water. Atop the solid banks was thick vegetation of grasses and shrubs such as hawthorn and dogwood. Large mature cottonwoods and ponderosa pines existed within the flood plain. Overall, impacts due to excess sediment either traveling through this section or depositing within it were not seen. The stream channel and substrate were in good to excellent condition.

As shown in Table 25, Elk Creek above Little Elk Creek fully supported beneficial uses. Field notes indicated a good riparian area.

Table 25. Elk Creek: DEQ water body assessment score.

DEQ Stream Site ID	SMI	SHI	SFI	Water Body Assessment Score	Beneficial Use Support Status
	(maximum score = 3)				
1997SLEWA025	3	2	3	2.67	Full Support

Conclusions

Elk Creek does not have impaired beneficial uses nor does aerial photograph analysis show any potential inputs of sediment due to management actions. A TMDL is not necessary and Elk Creek will be proposed for delisting from the 303(d) list for sediment.

Indian Creek

Originating at approximately 4,800 feet, Indian Creek (Figure 58) is a Rosgen Stream Type (RST) A and B first order, low volume stream (the branches of the stream shown on the map are either ephemeral or intermittent) located mainly in Idaho County (the headwaters are located in Adams County) between the small communities of Pollock and Pinehurst. Flowing from west to east, Indian Creek enters the Little Salmon River at approximately 2,500 feet and drains approximately 1,735 acres (Figure 59). The creek flows through a narrow, forested, V-shaped canyon area. Indian Creek is in assessment unit 17060210SL001_03.

Comparisons of aerial photographs, taken between 1994 and 2003, show that logging roads within the middle and upper section of the watershed have partially revegetated. Approximately 9 acres are developed south of the mouth of Indian Creek.

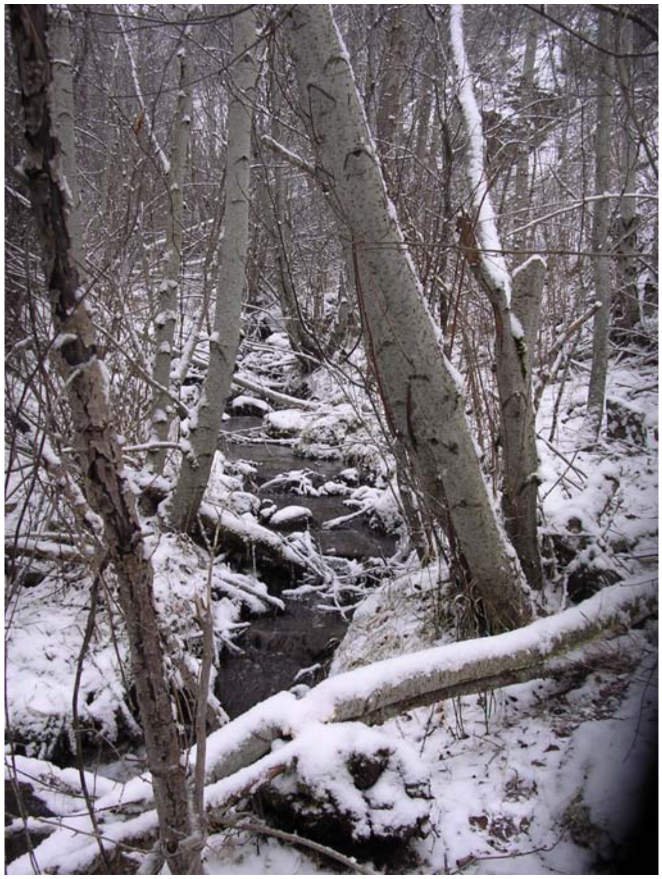

Figure 58. Indian Creek Near Mouth (November 2004).

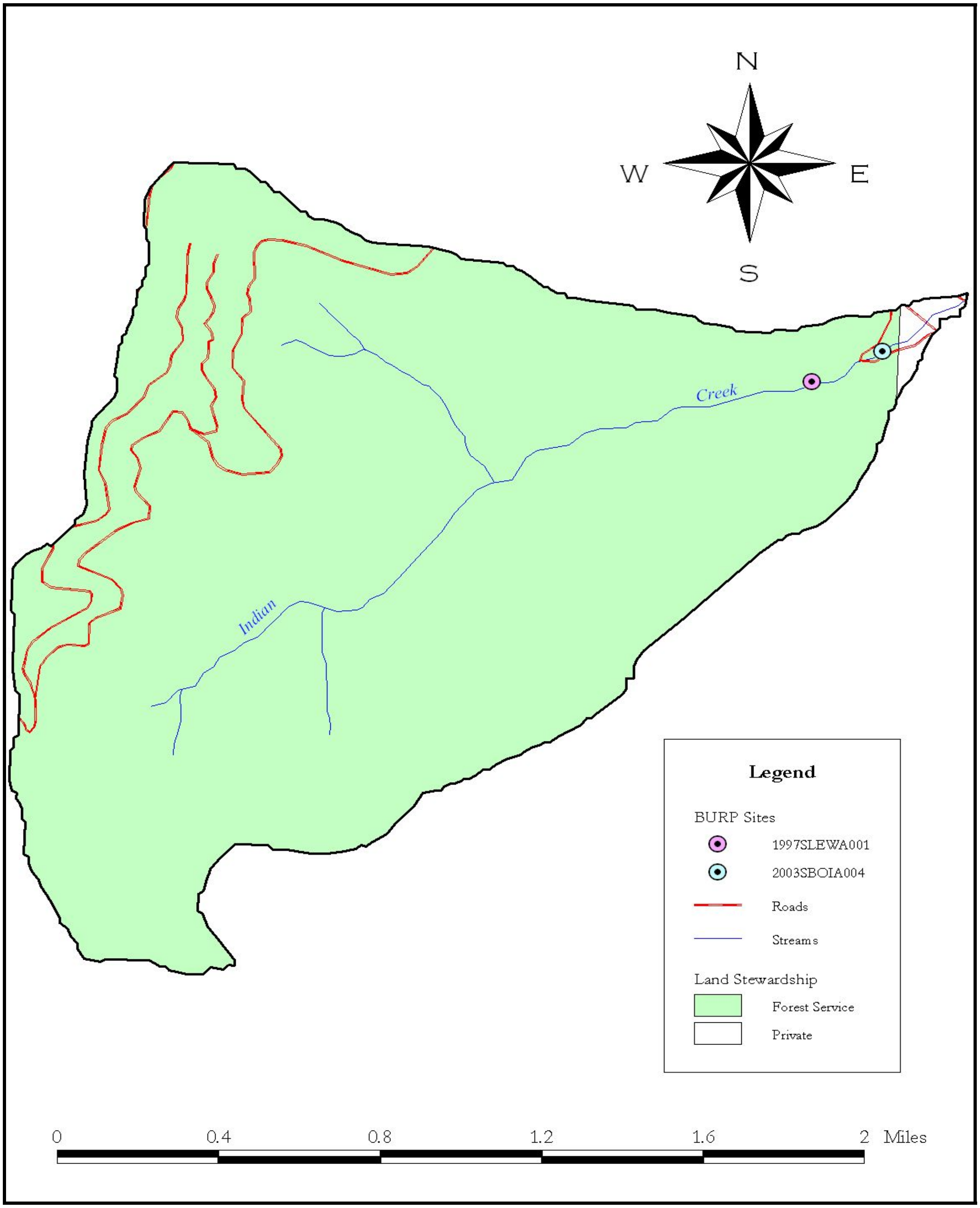

Figure 59. Indian Creek Subwatershed.

Geology

The parent materials in the watershed are schist and gneiss from the Baker terrane, an Idaho Batholith formation, while the rest of the watershed shows border/volcanic properties.

Vegetation

The primary vegetation within Indian Creek riparian zone is Grand fir, Douglas-fir, Engelmann spruce, alder and various forbs. The upland slopes are predominately Ponderosa pine and hawthorne overstory with an understory of grasses, forbs and shrubbery. The higher elevations are Douglas fir and lodgepole pine forested areas.

Land Use

Timber harvest has occurred in the watershed. There are no roads directly adjacent to the stream.

A natural landslide occurred in 1974 which affected fisheries in the stream in the short term. A trail that was located adjacent to the creek was also washed out at this time, and there are no plans to rebuild it. The trail is now overgrown and does not appear to be used.

Hydrology

Little flow information exists for Indian Creek. The creek is perennial, but base flows are below 1 cfs and flows likely remain below 5 cfs for much of the year (Figure 60).

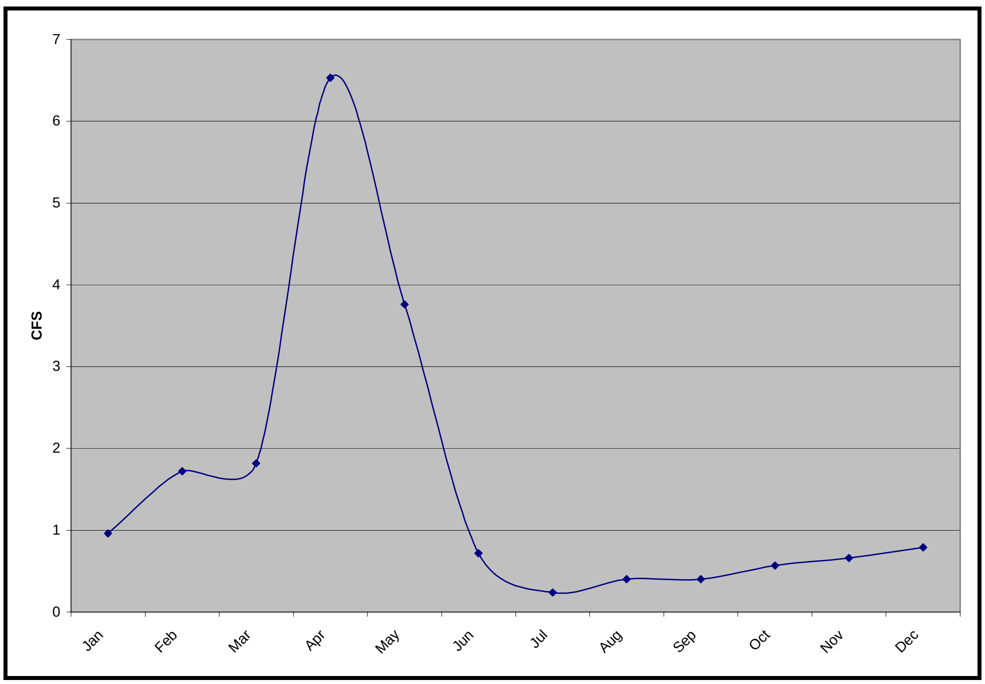

Figure 60. Indian Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

The fish that likely inhabit Indian Creek are brook and rainbow trout. The low hydrologic flows may not support fish populations within the upper reach of Indian Creek. In July 2005 a DEQ stream inventory crew tried to electrofish the creek but low flow prevented them from doing so.

Habitat Data

1997 DEQ stream inventory data indicated that the stream did not support beneficial uses and Indian Creek was put on the draft 2003 303(d) list for sediment. As shown in Table 26, the most recent 2003 DEQ data (taken in the same area as the 1997 inventory) shows that beneficial uses are not impaired.

The stream survey results indicated 26% surface fines, >80% stable banks, and 12.77 width/depth ratio. These results were compared to results for the same parameters seen in geologically similar pristine streams using reference condition work done by Overton (1995) to see if impairment from sediment was evident.

The 12.77 width/depth ratio is below the 16 width/depth ratio seen in pristine Rosgen Stream Type A streams of volcanic origin. The mean percent surface fines for Rosgen Type A channel streams (Overton 1995) is 25%. A surface fines score of 26% indicates that surface fines levels are close to that seen in pristine streams. Bank stability was also similar to that of pristine streams.

2004 data width/depth data taken near the mouth of Indian Creek indicated a width/depth ratio of 17 in a Rosgen Type B channel which is below the mean width/depth ratio of 27 seen in pristine streams, indicating that the channel is not excessively wide. Banks appeared stable throughout the ½ mile section walked by DEQ personnel.

Table 26. Indian Creek: DEQ water body assessment scores.

DEQ Stream Site ID	SMI	SHI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score = 3)				
2003SBOIA004	2	3	No data	2.5	Full Support
1997SLEWA001	1	1	No data	1	Not Full Support

Conclusions

The beneficial uses in Indian Creek are not impaired, and Indian Creek is recommended for delisting from the 303(d) list. No human caused sources of sediment appear to either threaten or currently impair beneficial uses in Indian Creek. Habitat measurements related to sediment were similar to conditions seen in pristine streams. No TMDL is necessary for Indian Creek.

First and Second Order Tributaries to the Little Salmon River below Round Valley Creek

The following sections on Sheep, Rattlesnake, Lockwood, Denny, Hat and Fall Creeks all discuss similar first and second order streams that lie in the Little Salmon River assessment unit (17060210SL001_02) (Figure 61).

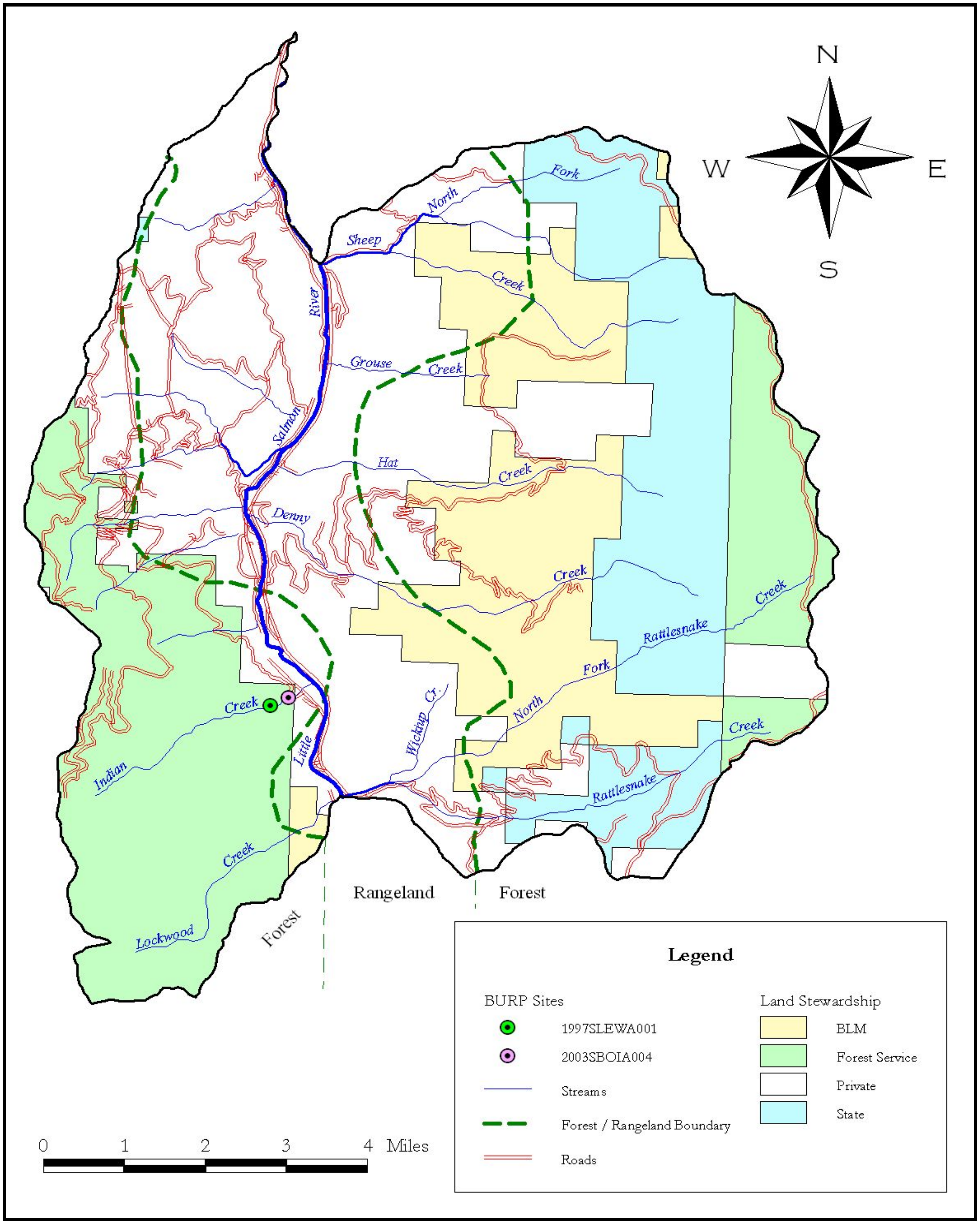

Figure 61. Lockwood, Indian, Rattlesnake, Denny, Hat, and Sheep Creeks.

Sheep Creek

Sheep Creek (Figure 62) is a second order stream that flows into the Little Salmon River at river mile 6.9. The watershed is 4,291 acres in size. The elevation at the mouth is 1,900 feet and the highest elevation in the drainage is 7,718 feet. Sheep Mountain (elevation 7,415 feet) borders the east side of the watershed and Indian Mountain (elevation 7,113 feet) borders the north side.

Sheep Creek flows through a steep sloped V-shaped canyon. The upper watershed is timbered while the lower portion of the watershed is a mixture of grasslands and timbered sites. A residence is located along Sheep Creek near the mouth.

Land Use

State lands comprise approximately 38% of the ownership, 34% are BLM lands, private lands 23%, and Forest Service total 5%. No public access exists in the lower drainage, however, public access is provided to the upper watershed.

Land uses which have impacted the drainage include logging, roads, and livestock grazing. Livestock grazing on private lands in the lower watershed has resulted in localized areas of stream bank degradation. Very light use to no use from livestock occurs on BLM and USFS lands along the creek in the upper watershed.

Hydrology

The stream is primarily a Rosgen Stream Type (RST) A channel with a steep gradient ranging from 10 - 25%. The dominant RST is A3+. Figure 65 shows estimated monthly flows for Sheep Creek.

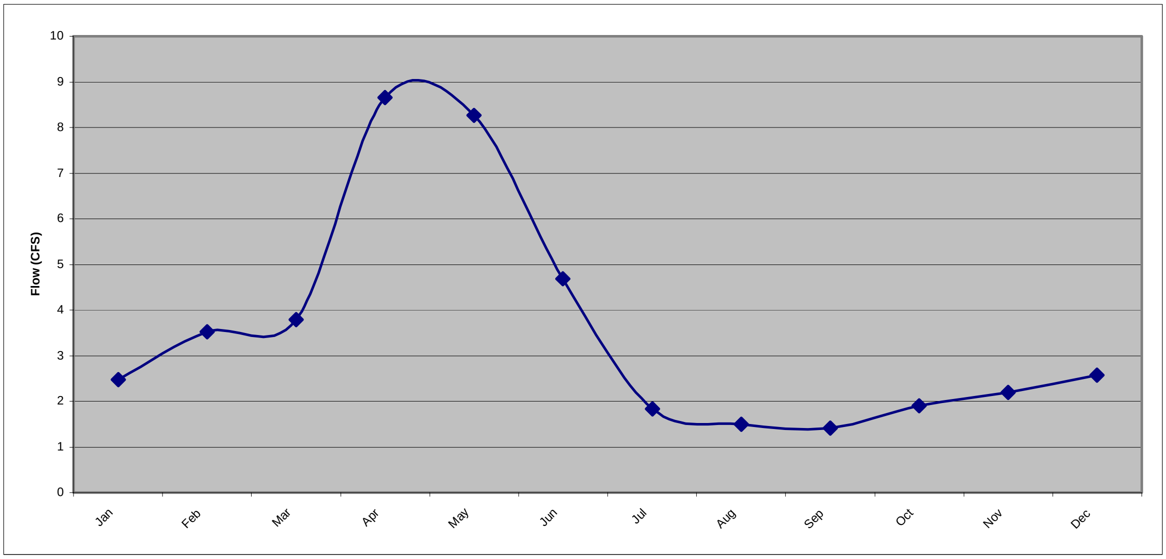

Figure 62. Sheep Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

Sheep Creek provides spawning and rearing habitat for rainbow/steelhead trout. A 15 foot falls at stream mile 0.7 is a complete fish passage barrier therefore documented steelhead spawning is limited to the lower reach. The mouth area or lower reach segment provides limited value for spring/summer Chinook rearing. No bull trout use has been documented for this stream. Ringe et al. (1978) sampled two sections of Sheep Creek in 1977. Ringe et al. (1978) found rainbow/steelhead near the mouth and found no fish approximately one mile (upstream from falls) from the mouth. A local resident has reported that rainbow trout do occur upstream from the barrier (BLM 2000).

The BLM monitored fish populations in 1982 at stream mile 0.4 and only found rainbow/steelhead trout. Densities of over-yearling rainbow/steelhead trout were estimated at 0.10 fish per square meter and young of the year fish densities were 0.21 fish per square meter (BLM 2000).

Habitat Data

The BLM has a permanent greenline monitoring station established on Sheep Creek (stream mile 3.1). Monitoring in 1993 and 1995 documented no unstable stream banks, and no recent signs of livestock use. The primary limiting factors for fish production in Sheep Creek include steep gradient, lack of good quality pools, and deposited sediment. The steep gradient has prevented the formation of good quality pools and sediment is deposited in the existing pools due to the step/cascade morphology of the stream. These limiting factors are natural not anthropogenic in nature.

Conclusions

Limited information is available for Sheep Creek, but the information available for this creek and similar streams (Rattlesnake, Hat, Lockwood and Denny Creeks) suggests that beneficial uses are not impaired. A TMDL is not necessary.

Hat Creek

Hat Creek (**Figure** 63), a first order stream, flows into the Little Salmon River at river mile 9.3. The watershed is 3,389 acres in size. The elevation at the mouth is 2,315 feet and the highest elevation in the drainage is 7,975. Hat Creek flows through a steep sloped V-shaped canyon. The upper watershed is timbered while the lower portion of the watershed is a mixture of grasslands and timbered sites.

Land Use

State lands comprise approximately 21% of the ownership; BLM lands 35%, private lands 31%, and Forest Service total 20%.

Land uses which have impacted the drainage include logging, roads, livestock grazing, and recreation. Very light to no use from livestock occurs on BLM and USFS lands along the creek in the upper watershed. A BLM public access road provides access to BLM managed lands: however, the lower portion of the drainage is primarily private lands.

Hydrology

This stream is primarily a Rosgen Stream Type (RST) A channel with steep gradients (10 - 20%), the dominant RSTs are A3+, A3, and A2. Hat Creek is a low volume stream, and flows are generally below 15 cfs (Figure 66).

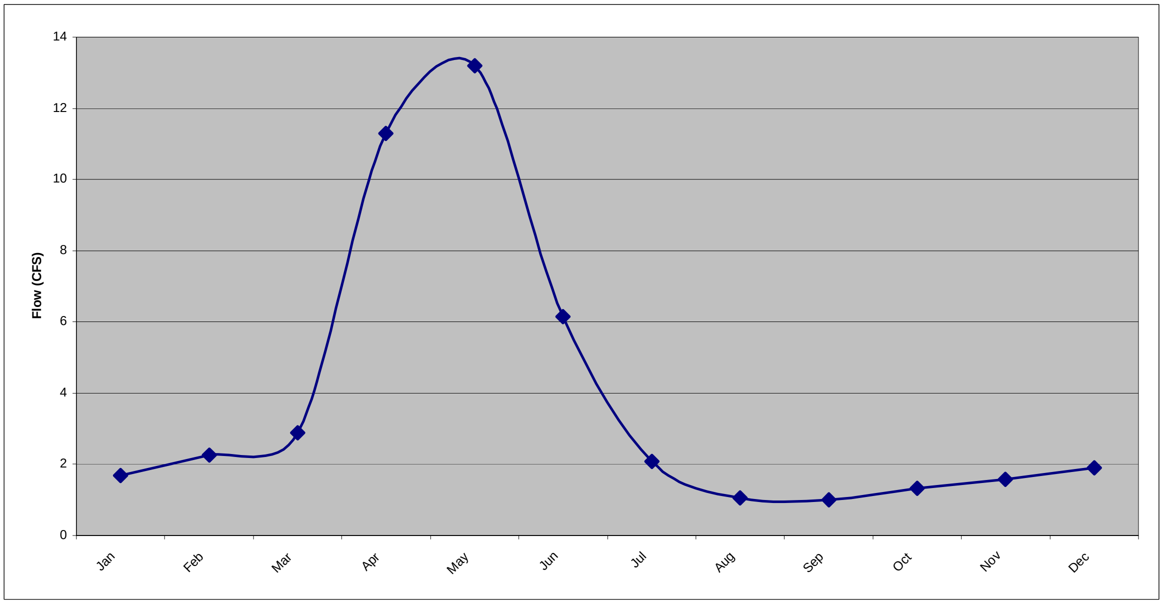

Figure 63. Hat Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

Hat Creek provides spawning and rearing habitat for rainbow/steelhead trout. A steep gradient cascade/falls is located at stream mile 0.05 and is a complete fish passage barrier. Hat Creek has documented adult steelhead use below the barriers. The mouth area or lower reach segment provides marginal habitat for spring/summer Chinook rearing. No bull trout use has been documented for this stream. In 1982, the BLM documented the presence of rainbow trout at stream mile 3.0.

Habitat Data

The BLM has a permanent greenline monitoring station established on Hat Creek (stream mile 3.1). Monitoring in 1995 documented no unstable stream banks and light livestock use.

Conclusions

Information available for Hat Creek and similar streams (Rattlesnake, Sheep, Lockwood, and Denny Creeks) indicate that beneficial uses are not impaired. A TMDL is not necessary for Hat Creek.

Denny Creek

Denny Creek, a first order stream, flows into the Little Salmon River at river mile 9.7. The watershed is 2,624 acres in size. The elevation at the mouth is 2,380 feet and the highest elevation in the drainage is 7,385 feet. Denny Creek flows through a steep sloped V-shaped canyon. The upper watershed is timbered while the lower portion of the watershed is a mixture of grasslands and timbered sites.

Land Use

State lands comprise approximately 13% of the ownership, private lands 41%, BLM lands 33%, and Forest Service 1%.

Land uses which occur in the drainage include logging, roads, livestock grazing, and recreation. Very light to no use from livestock occurs on BLM and USFS lands along the creek in the upper watershed. A BLM public access road provides access to BLM managed land. However, the lower portion of the drainage is primarily private lands.

Hydrology

This low volume stream is primarily a RST A channel with steep gradients (15 - 30%) and the dominant RSTs are A3 and A3+.

Fisheries

Denny Creek provides spawning and rearing habitat for rainbow/steelhead trout. At stream mile 0.05, there is a steep gradient cascade/falls which is a complete fish passage barrier. Denny Creek has documented adult steelhead use below the barriers. The mouth area or lower reach segment provides marginal habitat for spring/summer Chinook rearing. No bull trout use has been documented for this stream. The only occupied fish habitat occurs in the lower 0.05 mile of stream below the barrier (BLM 2000).

Habitat Data

No habitat data is available.

Temperature

Temperature data is limited; the highest recorded summer temperature was 14^{o} C in 1983. The primary limiting factors for fish production in Denny Creek include steep gradient, barriers, low flows, lack of good quality pools, and deposited sediment.

Conclusions

Information available for Denny Creek and similar streams (Rattlesnake, Sheep, Lockwood, Fall, and Hat Creeks) indicate that beneficial uses are not impaired. A TMDL is not necessary for Denny Creek.

Lockwood Creek

Lockwood Creek (Figure 64), a first order stream, flows into the Little Salmon River at river mile 12.8. The watershed is 1,803 acres in size. The highest point in the drainage is Lockwood Point, elevation 6,969 feet. Lockwood Creek flows through a steep sloped V-shaped canyon. The watershed is primarily timbered with brush patches.

Land Use

The majority of Lockwood Creek is within USFS managed public land, 8 % (140 acres) is BLM lands, and the land right at the mouth is under private ownership.

Land uses which have impacted the drainage include logging, roads, and livestock grazing. A residence occurs near the mouth of this creek and a water diversion is used for irrigation of private lands.

Lockwood Creek is within the USFS Fall Creek/Whitebird Ridge C&H grazing allotment. In 2004, the permit allowed 240 cow/calf pairs to graze USFS land between June 10 and October 31. Very light use to no livestock use occurs on BLM lands.

This stream has experienced periodic severe flood scouring damage. The most recent flood event occurred January, 1997.

Hydrology

This low volume stream is primarily a RST A channel with steep gradients (6 - 15%) and the dominant RSTs are A3+ and A3.

Fisheries

Lockwood Creek provides spawning and rearing habitat for rainbow/steelhead and has documented adult steelhead use. The mouth area or lower reach segment provides marginal habitat for spring/summer Chinook salmon juvenile rearing, however, no Chinook use has been documented. No bull trout use has been documented in this stream. Ringe et al. (1978) sampled Lockwood Creek in 1977 and found rainbow/steelhead trout in the lower 0.7 mile of stream (upper BLM boundary), and found no fish above the BLM boundary in 104 seconds of electrofishing. The BLM monitored fish populations in 1986 at stream mile 0.4 and only found rainbow/steelhead trout. Densities of overyearling rainbow/steelhead trout were estimated at 0.33 fish per square meter, and young of the year fish densities were 0.16 fish per square meter (BLM 2000).

Habitat Data

The BLM has a permanent greenline monitoring station established on Lockwood Creek (stream mile 0.4). Monitoring in 1994 documented 1% unstable stream banks, and no livestock use. It should be noted that the 1997 flood event resulted in severe channel and bank scouring. A 2004 PfanKuch Channel Stability Evaluation found fair and good conditions on the mainstem on forest service lands.

Conclusions

Information available for Lockwood Creek and similar streams (Rattlesnake, Sheep, Denny, Fall, and Hat Creeks) indicates that beneficial uses are not impaired. A TMDL is not necessary for Lockwood Creek.

Rattlesnake Creek

Rattlesnake Creek, a second order stream, flows into the Little Salmon River at river mile 12.9. The watershed is 4,954 acres in size. The highest point is an unnamed peak above Elk Lake, with an elevation over 8,000 feet. Rattlesnake Creek flows through a steep sloped V-shaped canyon. The watershed is grassland and timbered in the lower drainage, while the upper drainage is mostly timbered.

Land Use

Majority of Rattlesnake Creek drainage is private and state ownership; 28% are BLM lands, and a small portion of the headwaters is within Forest Service lands.

Land uses occurring in the drainage include logging, roads, and livestock grazing. Very light use to no livestock use occurs on stream segments crossing BLM or UFSF lands.

Hydrology

This stream has experienced periodic severe flood scouring damage. The most recent flood event occurred in January, 1997. In 1974, the lower reach of Rattlesnake Creek was severely damaged by a flood, which severely degraded fish habitat (BLM 2000). The stream is primarily a RST A channel with steep gradients (10 - 20%). The dominant RSTs are A3+ and A3. Flows in Rattlesnake Creek are estimated to remain below 20 cfs throughout the year (Figure 64).

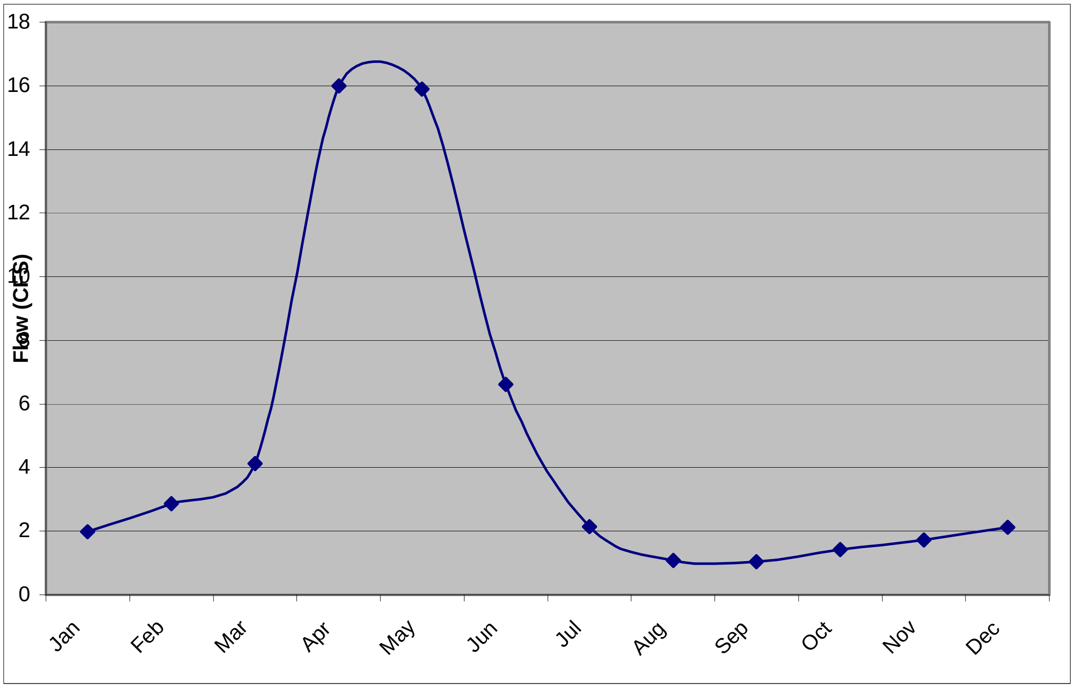

Figure 64. Rattlesnake Creek Average Monthly Flow at Mouth (Estimated Using StreamStat).

Fisheries

Rattlesnake Creek provides spawning and rearing habitat for rainbow/steelhead in the mouth area and lowest reach segment (150 feet). Rattlesnake Creek has documented adult steelhead use. A cascade/fall restricts fish passage at stream mile 0.05. During the early 1960s when the existing Highway 95 bridge was constructed, the highway and bridge resulted in the creation of the fish passage barrier approximately 150 feet from the mouth of Rattlesnake Creek (BLM 2000). The mouth area or lower reach segment provides marginal habitat for spring/summer Chinook rearing. No Chinook salmon use or bull trout use has been documented for this creek. Rattlesnake Creek was sampled in 1977 and rainbow trout were found.

The primary limiting factors for fish production in Rattlesnake Creek include steep gradient, lack of good quality pools, channel and stream bank scouring, barriers, lack of in-stream cover, and sediment. The North Fork of Rattlesnake Creek flows into Rattlesnake Creek at stream mile 0.5. The BLM monitored fish populations in 1986 in the North Fork of Rattlesnake Creek at stream mile 0.4 and only found rainbow/redband trout. Densities of over-yearling rainbow trout were estimated at 0.2 fish per square meter, and young of the year fish densities were 0.1 fish per square meter (BLM 2000).

Habitat Data

No habitat information was available for Rattlesnake Creek.

Temperature

Temperature data is limited; the highest recorded summer temperature was 17^{o} C in 1979.

Conclusions

Information available for Rattlesnake Creek and similar streams (Lockwood, Sheep, Denny, Fall, and Hat Creeks) indicates that beneficial uses are not impaired. A TMDL is not necessary for Rattlesnake Creek.

Fall Creek

Fall Creek, a first order stream, flows east into the Little Salmon River at river mile 16.2. The watershed is 1,782 acres in size. The highest point is an unnamed peak above 7,000 feet in elevation, and the second highest is Lockwood Point at 6,969 feet. The watershed is primarily timbered with shrubs and some grassland openings.

Land Use

Fall Creek flows through Forest Service, BLM, and private lands. Ownership is approximately 33% for each.

Land uses occurring within the drainage include logging, roads, and livestock grazing.

Fall Creek is within the USFS Fall Creek/Whitebird Ridge C&H grazing allotment. In 2004, the permit allowed 240 cow/calf pairs to graze USFS lands between June 10 and October 31. Very light to no livestock use occurs on BLM lands adjacent to Fall Creek.

Hydrology

This low volume stream is primarily a RST A channel with steep gradients (7 - 25%). The dominant RSTs are A3+ and A3.

Fisheries

A 25 foot falls occurs within 100 feet of the Little Salmon River. No documented adult steelhead use is known to occur in Fall Creek; however, steelhead may potentially use the mouth area or lower 25 feet for juvenile rearing. The mouth area or lower 25 feet provides limited value for spring/summer Chinook rearing. No bull trout use has been documented for this stream. Ringe et al. (1978) sampled two sections of Fall Creek in 1977, electrofishing two sections of this stream. The survey found rainbow trout at stream mile 0.75 but no fish at stream mile 1.5. The BLM monitored fish populations in 1986 at stream mile 0.9 and found only rainbow trout (Johnson 1986C). Densities of over-yearling redband/rainbow trout were estimated at 0.06 fish per square meter (Johnson 1986C). A stream survey of Fall Creek was conducted during 1982. A ten foot fall occurs at stream mile 1.1, and it is believed that this may be the upper limit of fish presence in Fall Creek (BLM 2000). Fish were observed in the creek below the falls, but no visual observation was made of fish upstream from the falls (stream mile 1.1).

Habitat Data

No habitat data is available for this stream.

Conclusions

Information available for Fall Creek and similar streams (Lockwood, Sheep, Denny, Rattlesnake, and Hat Creeks) indicates that beneficial uses are not impaired. A TMDL is not necessary for Fall Creek.

Rapid River

Rapid River is a fifth order tributary to the Little Salmon River, located about four miles south of Riggins (Figure 65 and Figure 66). The entire watershed is 80,017 acres in size, 21,991 acres of which are in West Fork and 7,919 acres in Shingle Creek. Aside from the West Fork, major tributaries include Paradise Creek, Lake Fork and Granite Fork. The upper watershed features bare rock and alpine lakes, such as Black Lake, Crystal Lake and Satan Lake.

The watershed is bounded on the east by White Bird Ridge and Pollock Mountain (elevation 8,048 feet). The spine of the Seven Devils Mountain range forms its western boundary and includes named peaks such as The Ogre, The Goblin, Heavens Gate (elevation 8,428 feet), She Devil, Tower of Babel, Mount Belial and The Devils Farm. The southern boundary of the watershed is formed by Pyramid Peak (elevation 8,360 feet), Echols Mountain (elevation 8,327 feet) and North Star Butte (elevation 7,451 feet). The highest points in the watershed are He Devil and Devils Throne mountains, both 9,280 feet. The Rapid River watershed encompasses assessment units 17060210SL002_02, 03 and_04.

Entering six miles from Rapid River's confluence with the Little Salmon River, West Fork Rapid River is a fourth order stream with an average gradient of 14%. Its headwaters lie on Middle Mountain, Black Imp, Horse Heaven, and Carbonate Hill. Its major tributaries are Dog Creek, Hanson Creek and Bridge Creek. The upper watershed is dotted with many alpine lakes, including Slide Rock Lake, Cannon Lakes, Mirror Lake and Dog Lake. The headwaters of West Fork Rapid River have a steep gradient, and flow through a narrow enclosed canyon for the first five miles, after which the gradient decreases.

Upon passage of Public Law 94-199 on the last day of 1975, Rapid River was added to the national list of Wild and Scenic Rivers. The main stem was protected from the headwaters to the National Forest boundary, and the West Fork was protected from the wilderness boundary to its mouth. Both were designated as 'Wild' rivers, the most pristine designation established in the act. In the words of the Wild and Scenic Rivers act, "…these (rivers) represent vestiges of primitive America".

Geology

The dominant geologic type is border/volcanics. This geologic type occurs on the borders of the Idaho Batholith granitics with scattered outcrops of Columbia River Basalts throughout the region. It consists of granitic rocks, granitic gneisses, schist, quartzites, and other metamorphic rocks. This geologic type does not weather as quickly as central core rocks. Soil textures are medium to coarse and are generally highly erodible. The volcanics consist of various basalt formations that occur throughout the area. Basalts produce a medium to fine textured soil with low to medium erodibility (BLM 2000).

Figure 65. Rapid River Upstream of Fish Hatchery (March 2005).

Vegetation

Lower elevation riparian species include white alder, cottonwood, Rocky mountain maple, black hawthorn, willow, Douglas fir, dogwood, syringa, and birch. Mid to upper elevation riparian species include sub alpine fir, Engelmann spruce, Douglas fir, grand fir, alder, prickly currant, huckleberry, dogwood, syringa, willow, sweet-scented bedstraw, bead lily, starry solomon-plume, twisted stalk, lady fern, monkshood, meadow rue, and miner’s lettuce, depending on elevation, aspect, and canopy cover.

Upland Vegetation types are diverse and represent a range of seral stages, which are primarily influenced by past timber harvest, fires, and livestock grazing. Lower elevations are dominated by canyon grasslands and a mixed conifer over story, which includes Douglas-fir, grand-fir, larch, and ponderosa pine. Upper elevations are dominated by grand-fir, Douglas-fir, larch, Engelmann spruce, lodgepole pine, and sub alpine fir. The timber is interspersed with patches of perennial grassland, brush, and riparian vegetation (USFS 1993b).

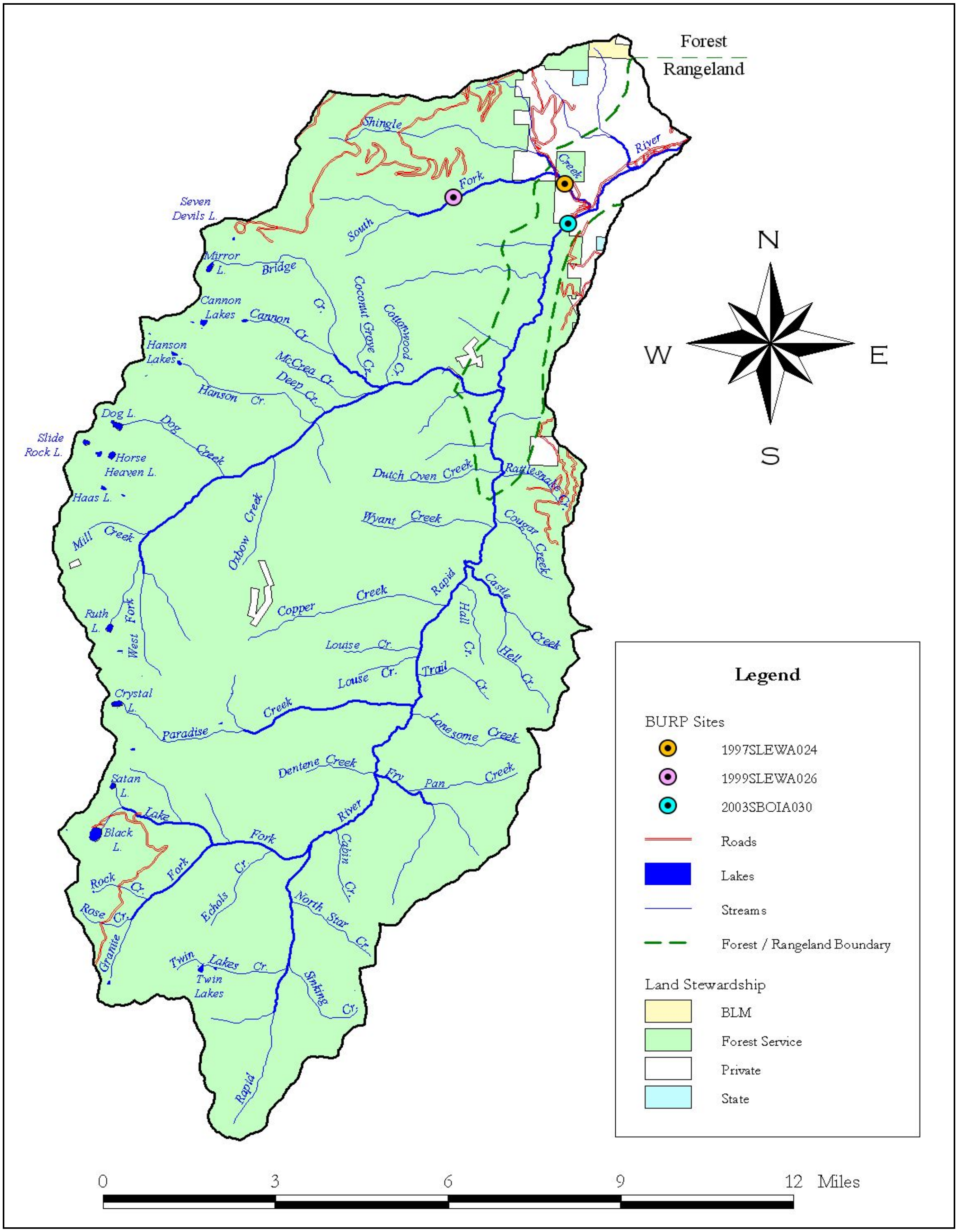

Figure 66. Rapid River Subwatershed.

Land Use

Public land makes up the majority of the watershed. Private lands are found only in the very lower portions of the watershed. The Nez Perce National Forest manages 33,719 acres (42%); Payette National Forest manages 42,430 acres (53%); private lands total 4,003 acres (5%); BLM lands total 152 acres (< .2%); and State lands total 43 acres (<0.1%).

The only major development occurs in the lower portion of the watershed and includes roads, residences, and the Rapid River Fish Hatchery. Primary land uses include cattle grazing, gardening, and minor amounts of timber harvest. High-use pasture areas and feedlots exist along 1.5 miles of lower Rapid River. Overall, there are no major land disturbing activities within Rapid River above the Payette/Nez Perce National Forest boundary. The watershed is used for recreation and has an extensive trail system.

Livestock grazing is permitted in part of the watershed. The Papoose Creek allotment permitted by BLM allows 27 animal unit months (AUMs) of cattle to graze. The USFS-Payette National Forest has three grazing allotments within the Rapid River watershed. The Fall Creek/Whitebird Ridge C&H allotment permits 240 cow/calf pairs to graze between June 6 and October 31. The Curren Hill S&G allotment permits 1650 dry ewe to graze between August 22 and September 30. The Echols Butte S&G allotment permits 950 ewe/lamb pairs to graze between July 19 and August 3.

There are 27 recorded water rights directly on the streams within the Rapid River watershed; in addition, numerous water rights are recorded for springs, smaller feeder streams, and ground water. Water rights are owned by federal, state, and private land owners. Of the water rights, two are for domestic use, nine are for irrigation purposes, four are for irrigation/stockwater use, two are for irrigation/domestic use, four are for fish propagation, and six are for power generation.

Road densities within this large watershed are low to non-existent. The lowest portion of Rapid River is within private lands and has a road density of 0.35 mi road/square mile, 59% within RCA. West Fork Rapid River has a low road density of 0.05 mi road/sq mile, none of which is within RCA. Lake Fork Creek, a headwater tributary to Rapid River has a high road density of 0.66 mi road/sq mile, but it is a small watershed with one main road that provides recreational access to the southern end of the Seven Devils Wilderness and the upper reaches of the Rapid River Wild and Scenic trail system. The Copper and Castle Creek drainages of Rapid River have a road density of 0.37 mi rd/sq mi, with only 0.68mi within RCA.

Hydrology

Stream gradient in Rapid River is moderate for the first three miles, becoming steeper as the river passes through a narrow, steep walled canyon. The river is 21 miles from its mouth to its headwaters. The lower sections are Rosgen Stream Type (RST) B3, B4, C2, C3, and C4. In the upper sections, the main stem and tributaries are typically RST A2, A3, B2, and B3 channels.

A gauging station on Rapid River, one quarter mile upstream of the fish hatchery, indicates that mean monthly high flows occur in May and June and mean monthly low flows occur in January and February (Figure 67). The highest daily average flow was 1275 cfs in 1986, and the lowest was 24.7 cfs in 1991. Many tributaries enter Rapid River and contribute substantial volumes of water.

The river has a high sediment transport capacity due to its steep gradient. Flash floods may occur, and are typically triggered by high-intensity summer thunderstorm, such as happened in 1975. Average precipitation in the watershed is thirty inches. High flows occur during rain-on-snow events or summer storms.

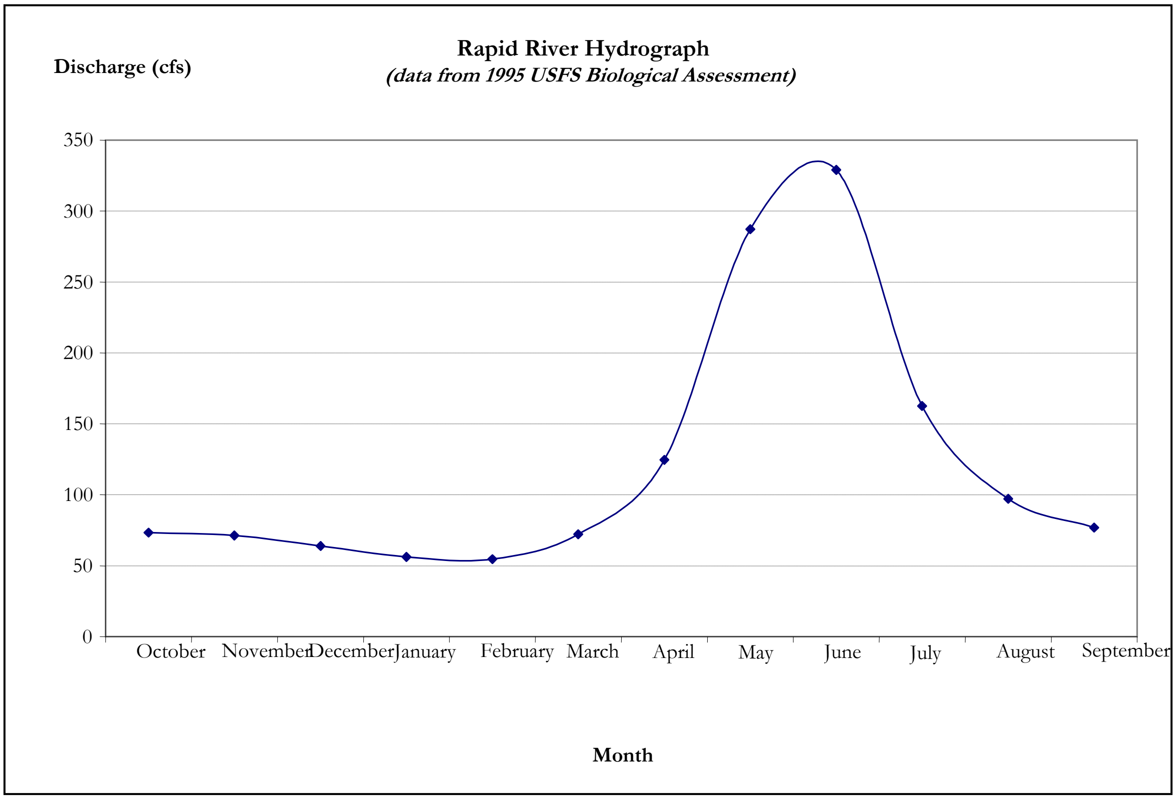

Figure 67. Rapid River Average Monthly Flow at Mouth (USFS).

Fisheries

Rapid River is used by bull trout for spawning and early rearing. Rapid River also is an important stream for spring/summer Chinook salmon and steelhead trout and provides good quality spawning and rearing habitat. Chinook salmon are found predominately in the lower third of the drainage based on snorkel observations. Brook trout are present in upper reaches of Lake Fork, a headwater tributary, and possibly in others as a result of past high mountain lake plants. Rainbow trout have also been observed in the upper reaches. Westslope cutthroat are present through out the drainage.

An Idaho Power Company fish hatchery for Chinook salmon is located on Rapid River, and is managed by Idaho Fish and Game. This hatchery was constructed in 1964 by Idaho Power

Company to serve as mitigation for sport fishing in the Hells Canyon Complex. The purpose of the hatchery is to replenish spring Chinook salmon supplies to the Hells Canyon Complex. A weir and trap about a mile downstream of the hatchery collects the migrating Chinook salmon and bull trout. The wild and natural Chinook are released upstream of the trap while the returning hatchery Chinook salmon are kept for spawning. The weir was reconstructed in late 2003 to early 2004 to minimize fish passage disruption.

The USFS Intermountain Research Station has monitored the bull trout throughout the Rapid River watershed. Adult bull trout have been observed migrating to the upper most reaches of Rapid River, West Fork Rapid River and Lake Fork, a tributary to West Fork Rapid River. These upper reaches appear to provide good spawning and rearing habitat for bull trout.

Habitat

Rapid River has a narrow stream channel with a mean width of 8 meters comprised largely of high gradient riffles, cascades and other fast water types (Figure 68).

The substrate is primarily cobble-rubble with some boulder within the lower to middle reaches. The swift RST B has some short RST A cascades within the confined canyon. As the stream approaches its headwaters, the substrate is more cobble to gravel sized with pocket pools behind boulders.

Figure 68. Rapid River (September 2003).

Rapid River originates within volcanic and plutonic parent material types. According to Overton, plutonic RST A, B, and C have reference condition mean percent fines of 26, 23%, and 37% respectively, while volcanic RST A, B, and C have reference condition mean percent fines of 25, 27%, and 17% respectively. Substrate monitoring within a RST B section of Rapid River show reference condition mean percent fines of 2.7 to 13.7% over the past 8 years. These values are below the Overton reference condition values for volcanic and plutonic RST B.

As shown in Table 27, Rapid River fully supports beneficial uses.

Table 27. Rapid River: DEQ water body assessment scores.

DEQ Stream Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
2003SBOIA030	3	3	3	3	Full Support

Temperature

Temperatures within Rapid River fall within required parameters for functioning at full support. Rapid River is a source of cold water for the Little Salmon River. Its steep canyon walls shield the water from solar warming. Natural cold springs flow into the subwatershed. Rapid River meets state water quality criteria for temperature (Figure 69). It is assumed that the temperature criteria for bull trout are met since those criteria apply at elevations over 4,592 feet and the temperatures shown here were measured at a much lower elevation.

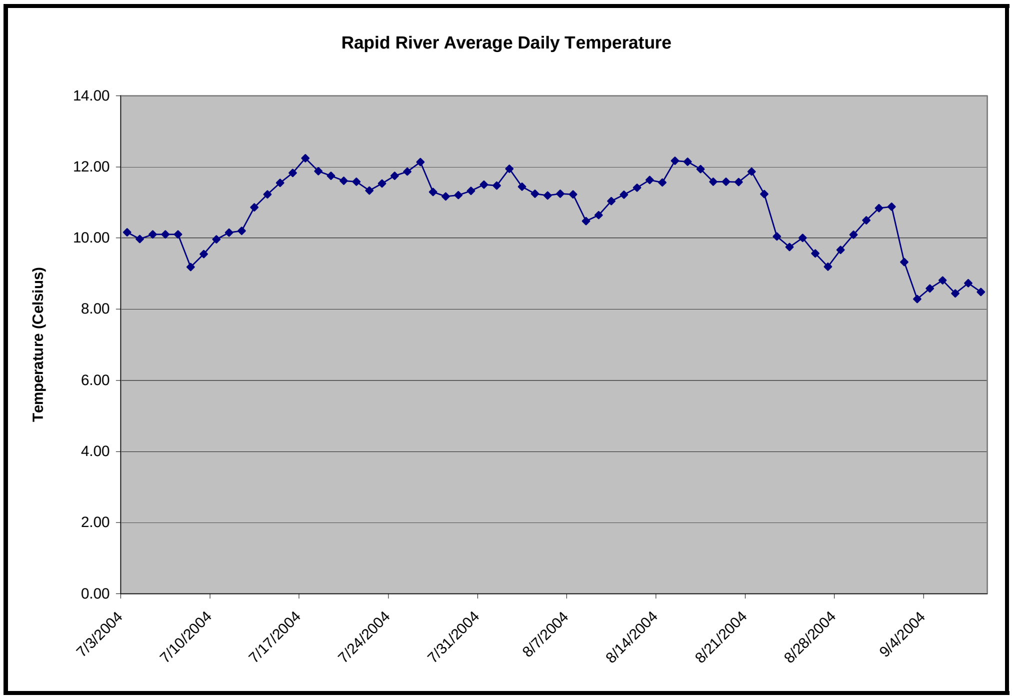

Figure 69. Rapid River Temperatures (USFS 2004).

Conclusions

Rapid River is protected by its Wild and Scenic River status, which minimizes the potential for human caused impairment of beneficial uses. The beneficial uses in the Rapid River watershed are not impaired, and a TMDL is not necessary.

Shingle Creek

Shingle Creek, a third order stream, is located about six miles southwest of Riggins. The watershed is approximately 7,750 acres, drains the north east flank of the Seven Devils Mountains and is primarily forested with a small wedge of rangeland at its mouth.

Originating from the eastern slopes of Heavens Gate at 8,429 feet and bounded on the north by McClinery Ridge, it flows in an easterly direction to its confluence with Rapid River at 2,180 feet elevation (Figure 70). Morrison Ridge divides Shingle Creek and its major tributary, South Fork Shingle Creek, which drains the north face of Cannonball Mountain (elevation 7,198 feet). A small tributary joins Shingle Creek from the north, and is identified on a 1929 water right claim as McGlimmer Creek. Shingle Creek lies in the Rapid River assessment unit with the exception of the first and second order sections of Shingle Creek, which forms its own assessment unit, 17060210SL002_02a. The reason for this delineation is that this represents the section of Shingle Creek that was listed on the 1998 303(d) list for sediment.

Geology

The geology of the lower half of Shingle Creek is dominated by mass wasted slopes derived from moderately weathered Columbia River basalt, Seven Devils volcanics, and associated limestone and slate. The erosion hazard is comparatively low for these materials, generating mostly silts, clays, gravels and cobbles. Waterfalls or alluvial fans may block fish passage. First and second order streams are prone to channel scour and debris torrents.

The upper reaches of Shingle Creek are dominated by steep glacial cirques and weakly developed glacial troughs with inclusions of convex ridges, colluvial slopes and moraines. The parent materials are poorly weathered sheared limestone and Seven Devils volcanics, generating mostly silt to cobble size material. This landform poses a moderate sediment delivery hazard. Channel morphology is defined by catastrophic events as well as bankfull flows. Debris torrent and debris avalanches can occur, most typically when intense fires are followed by intense storms. Subsurface flow can occur through limestone bedrock.

Vegetation

Throughout the watershed, slopes range from 40-80% and are dominated by ponderosa pine, Douglas fir, grand fir, western larch, lodgepole pine, subalpine fir and Engelmann spruce. Stand-replacing fires historically occurred on a 100-150 year cycle, with cooler surface fires occurring in the lower reaches at a 10-30 year interval. The riparian area changed from shrub-dominated (60%) in the lower reaches to conifer-dominated (45%) in the upper reaches. Forbs consistently made up about 10% of the riparian vegetation, with meadow plants noted in the upper reach.

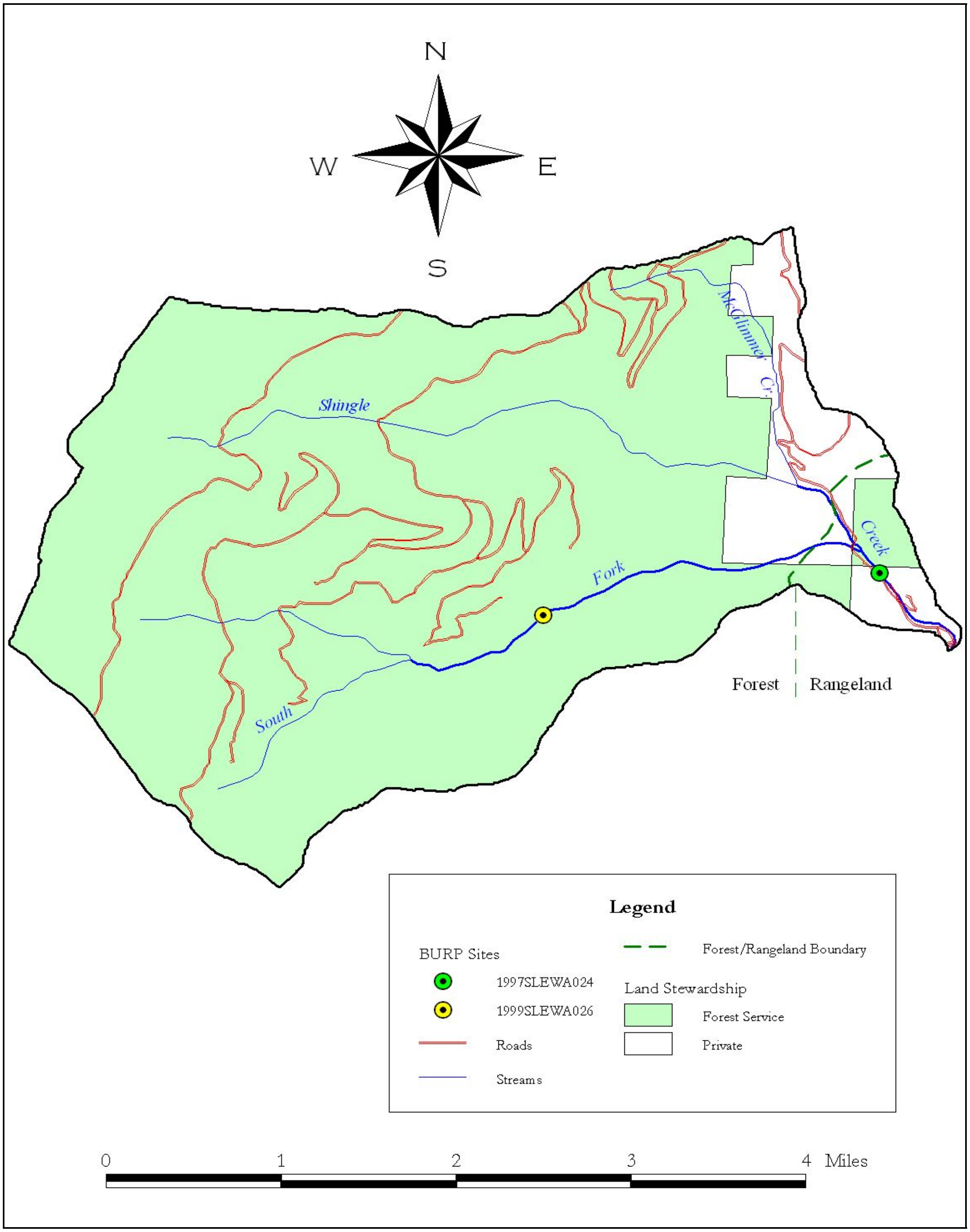

Figure 70. Shingle Creek Subwatershed.

Land Use

Most of the Shingle Creek watershed is managed by the Nez Perce National Forest (91%). Private land comprises the lower, more accessible 9%.

The Shingle Creek drainage is the only portion of the Rapid River basin that has been subject to recent timber harvest (1995 Biological Assessment). The Shingle Forks Timber Sale in the early 1990s harvested nearly nine million board-feet on 447 acres. Of that, 177 acres were clearcut and 166 acres were shelterwood cut. Roads were stabilized and maintained afterwards, and 278 acres were replanted. In some areas, some riparian areas were cut, but the 1997 stream surveys reported a ¼ mile riparian buffer left on main stem Shingle Creek.

Nearly the entire watershed is contained within the boundaries of two grazing allotments. The Cannonball Allotment (250 cow/calf pairs) encompasses the entire South Fork Shingle Creek drainage and the southern slopes of Shingle Creek. The Papoose Allotment (183 cow/calf pairs) includes the northern slopes of Shingle Creek. The 1995 Biological Assessment reported extensive grazing on the private lands in the lower watershed, with severe riparian impacts.

The Shingle Forks timber sale involved construction and reconstruction of several miles of roads. A few smaller roads appear to have been obliterated after the sale. ATV trails access the diversions at the bottom of the reach. The well used Seven Devils Road crosses Shingle Creek at the top of the watershed. Analysis of aerial photography did not find evidence of road failures.

A total of 28.61 miles of roads were identified in the watershed, and a road density of 2.31 miles/mile^2 calculated. Of these roads, 3.93 miles (14%) are within RCAs.

There are no known mines in the watershed. Recreational activities include hiking, horseback riding, hunting, gathering and mountain biking. The 1995 Biological Assessment noted that a youth mission camp development along Shingle Creek had caused severe impact to the riparian area.

Hydrology

Shingle Creek is a Rosgen Stream Type (RST) A3a+ channel. The stream drops nearly five thousand feet in less than six miles, entailing a very steep gradient, averaging 17%. The creek is composed of 30% pool, 60% riffle and 10% run.

Peak flows occur in June and fall to a minimum in January (Figure 71). Annual precipitation is approximately forty inches per year, falling mostly as snowfall.

There are fifteen water rights claims in Shingle Creek. Most of these are for less than 1cfs. A small, privately-owned hydroelectric power facility is located at the mouth of South Fork Shingle Creek, and has water rights to 9.94 cfs. The largest irrigation claim is for 2.64 cfs, and takes water from both Papoose and Shingle Creeks. There are no impoundments in the upper watershed.

The stream is often dewatered in the lower segment, and the upper reaches are perennial with marshy areas at the top. The middle section is intermittent, with the water sinking and reemerging from underground limestone caves. Springs on the northern side of the drainage are hydrologically linked to the adjacent Papoose Creek watershed through a system of caverns and faults.

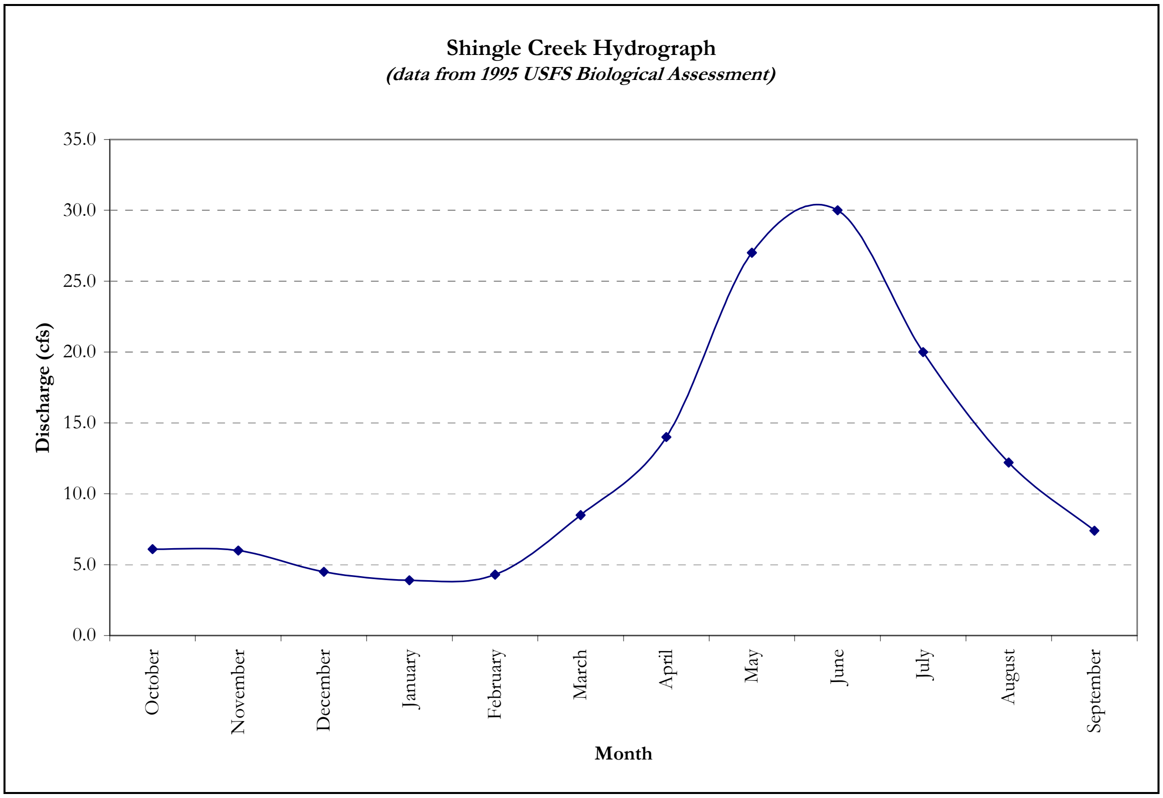

Figure 71. Shingle Creek Average Monthly Flow at Mouth (USFS).

Fisheries

The Idaho Department of Fish and Game has not stocked Shingle Creek or its tributaries since at least 1967. Electrofishing information collected by BURP survey crews revealed a rainbow trout and cutthroat trout fishery. The BURP data showed greater than three age classes of fish, including young of the year, which is indicative of a healthy fishery. Designated critical habitat for spring/summer Chinook salmon extends upstream about 1.3 miles from the mouth on the main stem and about 200 feet upstream on the South Fork. Most of this critical habitat is located on private lands. Shingle Creek supports steelhead spawning and rearing in the lower miles.

Between the years 1985-1993, four fish surveys were conducted due to the proposed installation of a hydro power project. Bull trout, rainbow trout, cutthroat trout and sculpin were reported at that time; however successive surveys have not shown the presence of bull trout. It is possible the stream is used for bull trout juvenile rearing.

The presence of Chinook salmon and steelhead was documented by the Rapid River Fish Hatchery manager in 1992. Chinook rearing habitat is marginal, most likely due to stream gradient. A 1997 stream survey noted a low to medium abundance of adequate spawning characteristics for anadromous fish. Several fish migration barriers were identified: two culverts with no jumping-off pools, waterfalls and cascades, and a dry (in September) segment where the water flowed underground through a cave system.

Biological and Habitat Data

Data collected in the Shingle Creek watershed includes two BURP sites, 1997SLEWA024 and 1999SLEWA026 (Figure 70). The former is located about half a mile upstream of the mouth of Shingle Creek and represents the third order section of the watershed. The latter, a second order site, is located about two miles upstream of the mouth of South Fork Shingle Creek and represents the entire South Fork watershed. Both indicated full support of beneficial uses (Table 28). There are no BURP sites in the first and second order sections of main stem Shingle Creek.

Table 28. Shingle Creek: DEQ water body assessment scores.

BURP Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score= 3)				
1997SLEWA024	3	2	3	2.67	Full Support
1999SLEWA026	3	3	3	3	Full Support

The Nez Perce National Forest conducted stream surveys of the main stem of Shingle Creek in 1997. The banks were 90% stable, with 25-50% undercut. The creek was moderately embedded with cobble particles 27-50% surrounded by fine sediment. RST A3 channels are typically dominated by cobbles but also contain some small boulders, gravel and sand. They are a high energy stream with a high sediment supply, and have a correspondingly high rate of bedload sediment transport. RST A3 bedrock channels occur as a step/pool cascades that often store large amounts of sediment in the pools associated with debris dams (Rosgen 1996).

Shingle Creek originates within volcanic parent material. According to Overton (1995), volcanic RST A and B have mean percent surface fines of 25 and 27% respectively. A Nez Perce Forest Service survey in 1997 showed the substrate varied between 5% and 31% fines and averaged to 14% fines, which is within the range of reference conditions.

Medium-high levels of large woody debris were identified throughout the survey reaches. In-stream cover was moderately high, and primarily consisted of organic debris and aquatic vegetation (USFS 1999).

2005 Wolman pebble counts in the mainstem of Shingle Creek in the Nez Perce Forest showed percent fines of <20%. Bank stability was rated at 100%. 2005 Wolman pebble counts near the mouth of Shingle Creek averaged 26%, bank stability was rated at 82% and the width:depth ratios averaged 34 which are all within the range of the mean of reference scores for RST B volcanic stream types. 27% is the mean for surface fines, 82% the mean for bank stability and 27 the mean for width:depth ratios for RST B volcanic streams.

Conclusion

The beneficial uses in Shingle Creek are not impaired. The high gradient of the upper Shingle Creek drainage limits habitat for fish. Within the lower section of the drainage where potential salmonid habitat exists, the combination of natural sinking of the water flow, culverts and irrigation diversions dewaters the lower sections late in the summer season. 2005 DEQ sediment information as well as DEQ water body assessment scores from South Fork Shingle Creek and upper Shingle Creek can be extrapolated to all the assessment units within the watershed, and these scores show that beneficial uses are not impaired. A TMDL is not necessary.

Squaw Creek

Squaw Creek originates at 7,200 feet and enters the Little Salmon River about river mile 1.1. It has a watershed of 11,829 acres.

Located in the far northwest of the Little Salmon River watershed, Squaw Creek is a third order stream that drains the northern tip of the Seven Devils Mountains (Figure 72). It flows eastward from its headwaters on Bald Mountain, Blue Mountain (elevation 6,302 feet) and a glacial cirque called The Narrows (elevation 7,356 feet) to its mouth about a mile southwest of the town of Riggins. Five miles upstream from its mouth, Squaw Creek splits into its North and South Forks, both second order, high-gradient streams. Squaw Creek lies in assessment unit 17060210SL001_03.

The major tributary to Squaw Creek is Papoose Creek, a second order stream that enters Squaw Creek from the south about 1.8 miles upstream from its mouth and originates from Papoose Lake, elevation 7,520 feet. Papoose Creek has a watershed of 4,196 acres. Papoose Creek is divided from the adjacent Shingle Creek watershed to the south by McClinery Ridge, and the two systems are hydrologically linked by springs and caverns.

The watershed has several caves. Many small tributaries, often flowing out of the ground, feed the headwaters. The high point of the watershed is an unnamed peak above Papoose Lake, at 8,210 feet. The lowest point is the mouth of Squaw Creek at 1,800 feet.

Squaw Creek is listed on the 1998 303(d) list for an unknown pollutant. The third order segment was delisted based on an assessment of a 1997 BURP site.

Comparison of aerial photographs taken in 1994 and 2003 show increased development within the lower reaches of Papoose Creek down to the mouth of Squaw Creek. Two new roads have been built to provide access for the new structures. No change is apparent within the upper sections of Papoose Creek, North Fork Squaw Creek, South Fork Squaw Creek or Rough Creek.

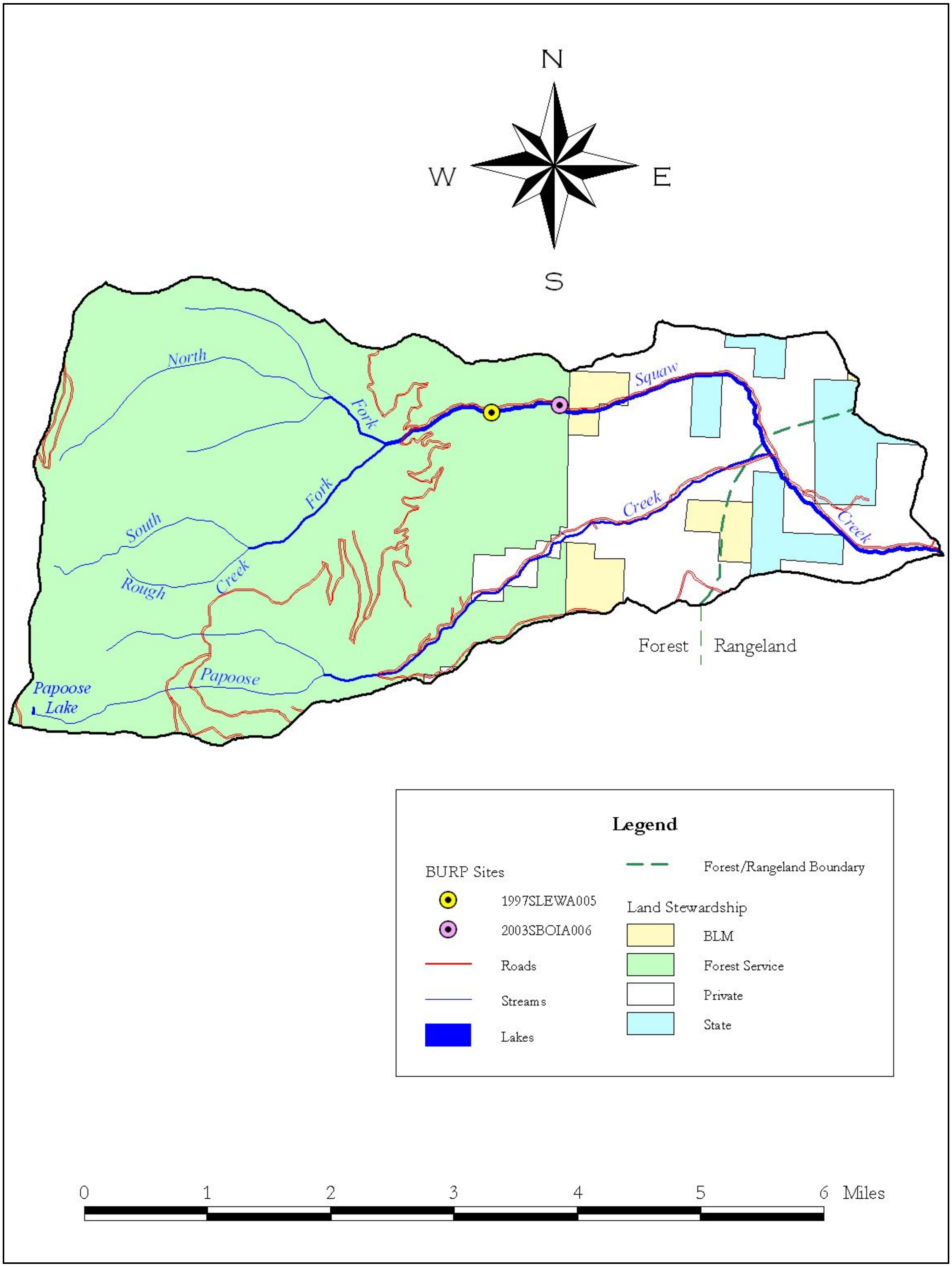

Figure 72. Squaw Creek Subwatershed.

Geology

The geology of Squaw Creek has been divided into three distinct areas (USFS 1995):

Headwaters:(25%)
The headwaters of Squaw Creek are dominated by steep glacial cirques and weakly developed glacial troughs with inclusions of convex ridges, colluvial slopes, and moraines. The parent materials are poorly weathered sheared limestone and Seven Devils volcanics, generating mostly silt to cobble size material. This landform poses a moderate sediment delivery hazard. Channel morphology is defined by catastrophic events as well as bankfull flows. Debris torrent and debris avalanches can occur, most typically when intense fires are followed by intense storms. Subsurface flow can occur through limestone bedrock.

Middle reaches:(72%)
The geology of the middle reaches of Squaw Creek is dominated by mass wasted slopes derived from moderately weathered Columbia River basalt, Seven Devils volcanics, and associated limestone and slate. The erosion hazard is comparatively low for these materials, generating mostly silts, clays, gravels, and cobbles. Waterfalls or alluvial fans may block fish passage. First and second order streams are prone to channel scour and debris torrents.

Lowest reaches (3%):
The lowest reaches of Squaw Creek are characterized by stream breaklands and mountain slopes derived from moderately well-weathered schist. The erosion hazard is high for this material, generating mostly fine sand to cobble materials. Sediment delivery efficiency is high and channel stability may depend on large organic debris and boulders. Waterfalls or alluvial fans may block fish passage.

Vegetation

Aside from the first hundred yards or so, all streams in the watershed are enclosed in fairly narrow, steep walled canyons. Only ten percent of the watershed had been burned in recent history by wildfire.

A 1995 USFS Biological Assessment (USFS 1995) identified the riparian areas in the upper reaches as about 55% conifers, 25% shrubs, and 20% forbs. Lower reaches featured 40% conifers, 5% meadows, 35% shrubs, and 20% forbs. Riparian zones help provide high degree of resistance to soil movement and quick regrowth.

Lower elevation riparian species include white alder, cottonwood, Rocky mountain maple, black hawthorn, willow, Douglas fir, dogwood, syringa, and birch. Mid to upper elevation riparian species include sub alpine fir, Engelmann spruce, Douglas fir, grand fir, alder, prickly currant, dogwood, syringa, willow, sweet-scented bedstraw, bead lily, starry solomon-plume, twisted stalk, lady fern, monkshood, meadow rue, and miner’s lettuce depending on elevation, aspect, and canopy cover.

Upland Vegetation types outside of the riparian area are diverse and represent a range of seral stages which are primarily influenced by past timber harvest, fires, and domestic animal grazing. Lower elevations are dominated by canyon grasslands and a mixed conifer over story which includes Douglas-fir, grand-fir, larch, and ponderosa pine. Upper elevations are dominated by grand-fir, Douglas-fir, larch, Engelmann spruce, lodgepole pine, and sub alpine fir. The timber is interspersed with patches of perennial grassland, brush, and riparian vegetation.

Hydrology

Average annual mean flow is 9 cfs, with a mean monthly high of 31 cfs in June and a mean monthly low of 3.4 cfs in January. The flows in Papoose Creek, a major tributary to Squaw Creek, are approximately eighty percent of those in Squaw Creek, and follow a similar hydrograph. The stream drops nearly six and a half thousand feet in about eight miles, entailing a steep gradient, averaging fourteen percent.

Annual precipitation is approximately thirty inches per year, falling mostly as snowfall. Runoff is dominated by spring snowmelt. Rain-on-snow events and summer thunderstorms may cause flash flooding in the watershed.

There are twenty seven water rights claims on Squaw Creek. Most of these are for less than 1 cfs. Two are for hydroelectric power projects, neither of which has been implemented. The City of Riggins has a water right to 12 cfs for irrigation supply to approximately 130 users. The water is conveyed to the city by a ditch built by the Works Progress Administration in 1938. A claim for 2.12 cfs is used to irrigate several small fields along Squaw Creek.

Land Use

All the Forest Service land in the watershed is contained within the Papoose grazing allotment, with a permitted maximum 787AUM (1 cow/calf pair = 1.32AUM). Year-round grazing occurred, until a rotational system was instituted in the 1970s. Within BLM lands, two grazing allotments within the Squaw Creek and Papoose Creek drainages exist. A total of 50 AUMs are permitted between these allotments.

According to the 1995 Biological Assessment (USFS 1995), grazing activity and development have occured on private lands in the lower reaches. Domestic animals have had access to the creek and timber harvest has included riparian areas.

Timber harvest occurred on 643 acres from 1971 through 1990, and was mostly the *seed tree* method, where up to 10% mature trees are retained. Mining was fairly minimal in the area, with small placer gold and lode copper operations running until the early 1900s. There is no active mining in the watershed.

All streams in the watershed have roads or trails paralleling their lengths. Squaw Creek Road follows mainstem Squaw Creek 100-200 meters away from the stream. Abandoned spur roads cross Squaw Creek, and only remnants of bridges remain. Most roads are used mainly for livestock, except for the well used Seven Devils Road, which follows Papoose Creek. Both the North and South Forks have old roads or trails paralleling the creeks. They are little used and overgrown. A trail crosses the South Fork six times within a mile.

In total, there are 28.01 miles of road in the drainage, which entails a road density of 1.51 miles/mile^2; 38% of the roads are within RCAs. The 1995 USFS biological assessment states that FS517 and FS487 (Squaw Creek Road and Seven Devils Road) cause severe riparian impacts.

Many of the roads have year-round or seasonal closures and are mostly stable. However, the 1997 BURP field crew noted that the Squaw Creek Road was closed four times in 1997 because of slides, at least one of which impacted the creek.

Recreation uses consist of camping, sightseeing, wildlife viewing, hiking, hunting, fishing, and gathering. The only developed campsite in the drainage is located on Papoose Creek, just inside the National Forest boundary. There are two recognized dispersed camping spots, and the limited number of accessible flat areas restricts use elsewhere in the watershed. The biological assessment noted that grazing activity and development has been extensive on private lands in the lower reaches, severely impacting riparian vegetation, and the channel has lost much shading. Livestock had free access to the creek, riparian irrigation was common, and timber harvest included riparian areas.

Fisheries

Electrofishing information collected by the 1997 stream survey crew indicated a rainbow trout/steelhead and westslope cutthroat trout fishery on the mainstem of Squaw Creek. The tributaries had cutthroat trout fisheries. No fish were found in the upper reaches of South Fork Squaw Creek. In the same surveys, the entire watershed was identified as possessing medium salmon spawning characteristics, with the exception of the upper reaches of South Fork, which had low spawning characteristics.

The majority of suitable habitat for steelhead trout occurs on private lands. Designated habitat for spring Chinook salmon extends upstream from the mouth for 120 yards. At approximately stream mile 0.1 (50 feet upstream from Highway 95) is a concrete and board diversion dam, which creates an eight to ten foot falls and cascade. The dam uses boards for the flood gate, which diverts water thru a weir into a ditch. This is a full fish passage barrier with dam boards in place at all flows, but may be a partial barrier during high flow periods when the boards are removed. Several diversion dams in the lower reach divert water into irrigation ditches. Some of these diversions may not be properly screened to prevent fish from moving into the ditches and possibly being stranded in fields (BLM 2000). However, this fish passage barrier is slated to be removed within the next five years. Another full passage barrier at most flows exists at the culvert below the Squaw Creek Road (USFS Rd. #517) which essentially limits access to spawning and early rearing habitat to the bottom 4-5 miles of Squaw Creek.

Private fish surveys, conducted for the hydropower applications, documented a rainbow trout/steelhead fishery in Squaw Creek. A 1989 Forest Service survey showed a healthy population of cutthroat trout at the forest boundary. No Chinook salmon or bull trout use has been documented in Squaw Creek. Westslope cutthroat trout use the stream for spawning and rearing. Steelhead trout may use Papoose Creek when flow conditions are suitable.

Limiting factors for fish production in Squaw Creek include deposited sediment, lack of good quality pools, man-caused barriers, and water diversions. Of these, man-caused barriers and water diversions are of the greatest concern.

Idaho Fish and Game has never stocked Papoose Creek, Rough Creek or North or South Forks of Squaw Creek. Squaw Creek itself has been stocked on two occasions. The first, in 1980, released two hundred catchable-size rainbow trout of an unspecified strain. In the second stocking, in 1989, twenty five thousand ‘A-run’ steelhead fry were released.

Biological and Habitat Data

Data collected in the Squaw Creek watershed include two BURP sites: 1997SLEWA005 and 2003SBOIA006. These are located three quarters of a mile upstream of and at the National Forest boundary respectively. Both represent the forested third order section of Squaw Creek, and both indicated full support of beneficial uses (Table 29). There are no BURP sites on Papoose, North Fork, South Fork, Rough Creeks, or on the lowermost reaches of Squaw Creek.

Table 29. Squaw Creek: DEQ water body assessment scores.

BURP Site ID	SHI	SMI	SFI	Assessment Score	Beneficial Use Support Status
	(maximum score 3)				
2003SBOIA006	3	3	3	3	Full Support
1997SLEWA005	3	2	1	2	Full Support

Mainstem Squaw Creek was identified as a Rosgen Stream Type (RST) A4. These channels are typically dominated by gravel, with small amounts of boulders, cobble, and sand. The RST A4 has both high energy and a high sediment supply, and a correspondingly high rate of bedload sediment transport. These channels are generally unstable, with very steep banks that contribute large quantities of sediment. Although, these channels are typically unstable, since Squaw Creeks supports beneficial uses, the creek appears to not have excess sediment in the system.

South Fork Squaw Creek was identified as a mix of RST A3a+ and A4a+, with a gradient increasing from thirteen to twenty-nine percent. RST A4a+ have similar characteristics to RST A4 types (see above), but with a gradient in excess of ten percent. They are often associated with debris avalanches and debris torrents. The gradient flattens off at the headwaters, where the creek has a run/glide habitat type. Again, although RST A streams are associated with large amounts of sediment, the current conditions in the creek show that sediment is not impairing beneficial uses.

North Fork Squaw Creek was identified as a RST A3a+, which is typically dominated by cobbles but also contains some small boulders, gravel, and sand. Gradient increased from twelve to twenty-three percent. RST A3a+ streams have both high energy and a high sediment supply, and a correspondingly high rate of bedload sediment transport. This channel type can occur as a step/pool cascade that often stores large amounts of sediment in the pools associated with debris dams (Rosgen 1996).

The Nez Perce National Forest conducted stream surveys of Squaw Creek, North Fork Squaw Creek, and South Fork Squaw Creek in 1997. Wolman pebble counts showed a high degree of variability, with fine particles ranging from nine to thirty-three percent. Relative amounts of silt generally tended to decrease further up the watershed (for example, North Fork had twenty-six percent fines at the mouth and nine percent at the top). This particle size distribution is likely due to the lower reaches having lower gradients, resulting in deposition of transported fine particles. South Fork Squaw Creek had the highest percentage of fine particles, averaging twenty-five percent. For these surveys, “fine particles” were considered those with intermediate axis less than 2mm. However, these results are within the range of reference conditions determined by Overton (1995) for pristine streams originating in volcanic parent material.

Overall, bank stability measurements were high throughout the watershed. Banks were generally more stable in the upper reaches (ninety-five percent) than in mainstem Squaw creek (eighty-five percent stable), where sloughing was noted. Undercut banks were more prevalent in the North and South Forks.

Throughout the watershed, riffle/pool dominated channels prevail, with cobble and gravel substrates.

Temperature

All instantaneous temperature data collected by various survey crews, including data from 2003, showed summer water temperatures from 8-10˚C.

Conclusions

Squaw Creek does not show impairment of beneficial uses and parameters related to sediment are all within in good quality ranges. A TMDL is not necessary for Squaw Creek.

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